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### THE METRIC SYSTEM.

In the current issue of *L'Industrie Electrique* reference is made to the growing favor with which the general introduction into Great Britain of the metric system is there viewed. The British, says our Gallic contemporary, are beginning to feel serious over their isolated position with respect to weights and measures, and strong efforts are beginning to be made to remedy this state of affairs. From the scientific field the discussion has passed to the Parliament, and a committee named by the House of Commons to study the question has just rendered a report advising the legalization of the metric system and its obligatory adoption at the end of two years. In line with this is a comment in the current issue of the London *Electrician*. In considering, in connection with the establishment of a magnetic system of units, the stumbling blocks in the way of reconciliation between scientific and commercial interests, the British system of weights and measures is enumerated as one of these, and the comment is added, that to this "no quarter need be given; many engineering firms have already replaced it, and it may be anticipated that in due time the replacement will become universal." After all, the United States in this, as in most international matters, will probably tail on after the mother country as if she were still a dependency, instead of taking action on her own account, as should long ago have been done.

### THE WESTINGHOUSE-BALDWIN COMBINATION.

In another column we give some details of the recent arrangement between the Westinghouse Electric & Manufacturing Company and the Baldwin Locomotive Works of Philadelphia, which, during the week, attracted so much attention on account of the stress laid upon it by the newspaper press. The union, it appears, is not the close one which has been represented, but merely amounts to a business agreement whereby the Westinghouse and Baldwin companies will each manufacture the parts of electric locomotives and high-power cars for which, by shop equipment and experience, the one or the other is best fitted. The former company, of course, will supply the electrical equipment and the other the remaining part of the rolling equipment. This is a most natural arrangement and similar in some respects to that which has existed for some time between the General Electric Company and the Schenectady Locomotive Works. It has too often happened that undertakings in which other than electrical questions enter have had unsatisfactory results through the electrical part alone receiving the necessary technical attention. As, however, it is always the electrical part which attracts the attention of the public, any failures will naturally reflect upon that side alone. It is, therefore, a matter for congratulation that the two great electrical manufacturing companies of the country, in entering a field as important as that connected with high-speed and long-distance traction, should have so wisely concluded to leave to locomotive builders that part of the work which contains no electrical problems, and would require for its handling an additional shop equipment and technical staff foreign to an electrical manufacturing establishment.

### ELECTRICAL FISH MEASUREMENTS.

In a recent communication to the French Academy of Sciences, D'Arsonval communicated some interesting results of measurements made on the electrical torpedo fish, which confirmed the theory advanced by him some years ago concerning the intimate relation between muscular contraction and electric discharge. By means of an ingenious apparatus, curves were obtained showing the phase and intensity of discharge, from which it was found that the discharges

are not continuous, but composed of several successive ones at intervals of a hundredth of a second, the intensity attaining a maximum at the end of the third discharge. The current has always the same direction, the back of the fish being always positive and the belly always negative. With fish from 10 to 14 inches in diameter, the E. M. F. measured oscillated between 8 and 17 volts and the current from 1 to 7 amperes. Among the interesting experiments described was one in which three incandescent lamps, in series, of four volts each and one ampere, were momentarily brilliantly lighted, and another in which two Geissler tubes were strongly illuminated. It was found that nervous excitation of the fish did not affect its electrical power, thus proving that this power is organic and not general. Another important fact observed was that if a stethescope is placed against the electric organ when a discharge is taking place, a sound can be heard corresponding to about 100 vibrations per second, showing that the organ is the seat of vibrations, as in the case of a muscle under contraction. It was also noticed that currents taken simultaneously from different places were not in phase, in one case a lag of four tenths of a second being observed. The observations and measurements made, of which we have only noted a few, are further indications of D'Arsonval's marked originality in research, and as in their continuation an attempt will be made to determine the exact origin and cause of the electric charge in this singular fish, the results may be of the highest scientific importance.

### PATENTS AND INVENTORS.

In another column Dr. E. B. Frost discusses, with reference to the Bell telephone monopoly, the very broad question of a rational patent system under the terms of the Constitution of the United States establishing protection for inventors. The question is one beset with difficulties, for by the very terms of the principles upon which our patent system is based, two antagonistic elements enter—the promotion of the general welfare and the property of an inventor in his patent. An invention once made, the public, on the one hand, desires to enjoy it with the least possible restriction while, on the other hand, the inventor endeavors to obtain the fullest pecuniary returns of which the monopoly granted him will admit. It may be said that the public should, in the interest of the progress of science and the useful arts, willingly concede recompense to an inventor, and that the latter should not assume the attitude of a Shylock with respect to his legal rights. Human nature, however, unfortunately intervenes, and instead of the abstractions of an enlightened public and an inventor laboring for the progress of the arts, we have a Mr. Smith endeavoring to obtain an article which he needs at the lowest price possible, and a Mr. Jones who endeavors to get as many dollars for his invention as he possibly can. Between the two are courts of justice supposed to see that each gets his due, but which in fact, merely give all to one or the other. To secure a better state of affairs, Dr. Frost proposes a method involving, first, the right of any one to manufacture an invention upon payment of a royalty to the inventor; second, the finality of a Patent Office award of a patent. While there is much to be said in favor of the first principle stated, yet it is doubtful if its operation would be practicable in most cases. As applied to the Bell Telephone Company and other powerful corporations owning valuable patents, the method would probably work, as such companies would be able to keep track of those manufacturing under its patents, to suppress unauthorized manufacture and guard against the sale of their products. The case, however, would be very different with respect to minor inventions. With every one possessing the right of manufacturing a patent article, it would seem to be impossible in the case of the great majority of inventors to keep track of their royalties, and not less so for the government to do so for them by means of a patent stamp system. The inventor could not personally see that he was receiving the correct amount of royalty from perhaps hundreds of manufacturers in every section of the country, and the value of the great majority of patents would not admit of the attempt. On the other hand, employees of the United States Government, however skillful and numerous, would be unable, except, perhaps, in a few cases, to discriminate from among all the articles exposed for sale within their territory those which should carry a patent stamp. In other words the result would be that great monopolies would be protected in the rights accorded under such a method, no others would. The second principle proposed—that a Patent Office grant of a patent should be a grant of as good a title as a grant to public lands—is not stated in direct terms, but if it implies that a grant by the Patent Office should be final and not reviewable by the courts, it is utterly indefensible. During 1894 almost 1,700 electrical patents were issued, and when we consider that in patent suits the record of examinations made with a view to determining the validity of a single patent sometimes amounts to thousands of printed pages, involving the labor of experts for months, it becomes apparent how utterly impossible it would be to maintain a patent office force of sufficient size and quality to render a grant of a patent evidence that the invention it covers is one truly patentable. When a patent is granted to A it transgresses the rights of B if he is the true inventor, or the rights of the public, if the invention is not a new one. To deny, then, to B the right to establish his priority as to the invention, or to the public the right to establish its invalidity, would be an injustice so great as to render the introduction of any principle involving it totally out of the question.

### The Condensation of Fumes by Static Electricity.

In the current number of the Columbia School of Mines *Quarterly*, Mr. Malvern W. Iles, superintendent of the Globe Smelter, Denver, Col., calls attention to the desirability of some cheap method for the generation of static electricity to condense the fumes from volatile metals. The writer thinks that the subject of the volatility of gold, silver and lead has not received sufficient attention, many substances, like copper, which is classed by the practical metallurgists as being non-volatile, being found to suffer at least six per cent. loss in fumes. He believes that the invention of a cheap method for the generation of static electricity will enable metallurgists to save a very large amount annually in the reduction of all the well-known volatile metals, and considers the matter one which will repay the attention of electricians. The article refers to the well-known experiments of Lodge in clearing an atmosphere clouded with dust and smoke, and calls attention to a United States patent granted to Alfred O. Walker, dated May 25, 1886 (No. 342,548), on a "Process of Depositing Solid Particles Suspended in the Air or Gas," and also to an article by E. Dieudonnè, printed in *La Lumière Electrique* in the Spring of 1886, on the "Condensation of Fumes by Static Electricity."

### The Welsbach Burner.

The London *Electrician* quotes the *Gas World* as saying that the general opinion among continental engineers appears to be that while the gas consumption is lessened the cost of renewing mantels more than counterbalances the saving in gas; they admit the better light but recognize no monetary advantage. This, it adds, may be quite true; and if it is, then what has to be done to make the Welsbach an economical street illuminator is to insure a longer life for the mantels. This might be done in two ways—either by making the mantel less fragile than it is at present, or by introducing some contrivance that would protect it from the vibration inseparable from our public streets; or it may be that the end may be attained partly in the one way and partly in the other. The Incandescent Gas Light Company, it says, with the object of protecting the mantel from vibration, has introduced a device consisting of carrying the mantel gallery upon three springs, which had given very promising results, reducing the mantel breakages by 90 per cent. But even after that great reduction the breakages in the particular case referred to were very heavy, amounting, in one case, to almost 29 mantels per annum. To renew a mantel 29 times in the course of a year would, it need hardly be said, be a very heavy burden upon the system.

### An Important Telephone Suit.

Papers were served last week on the National Telephone Manufacturing Company, at Boston, in behalf of the American Bell Telephone Company, of Boston, in a suit for an order restraining the latter from infringing the Berliner patent. Full particulars of the suit at this writing are lacking, but it is said that the case will test the validity of the Berliner patent, and will be fought by the National Company with the assistance of several other telephone corporations. Hearing is assigned before the United States Circuit Court for the first Tuesday in September. The present suit is the first one brought by the Bell Company under that patent, and its result will definitely determine its validity.

The bill of complaint recites that Emile Berliner was the original and first inventor of certain improvements in telephony; that he assigned to the American Bell Telephone Company his rights in the invention and that that company obtained patents on the same. The early history of telephone patents is reviewed, as well as that of the subsequent litigation. It is stated that the National Telephone Manufacturing Company is manufacturing and selling throughout the United States telephones which violate the patent rights of the Bell Company, and that practically the entire business of the defendant corporation consists in the manufacture and sale of telephones embodying and infringing the Berliner patents. The Bell Company prays that the National Telephone Manufacturing Company shall explain the construction of its telephones, and be required to account for and pay over to the Bell Company all profits which have or shall have accrued from the sale of these telephones, as well as such damages as may have been sustained by the Bell Company. The plaintiffs further ask for an injunction against the National Company, restraining it from making or selling any telephones infringing on the Berliner patents. The bill was filed Aug. 5 with the clerk of the United States Circuit Court at Boston. Bills of complaint have been filed also against the Bay State Telephone Company and the Century Telephone Company, of Boston, for infringement of the Berliner patent, and injunctions asked for.

### Inventions—An American View.

One of the experts who testified in the Brush arc lamp case asserted that the old country may be looked upon as having been the electrical laboratory of the new world, Europe, including Great Britain, he stated, having discovered and formulated nearly all the laws upon which electrical science is based. "It furnished us with the principles upon which we have constructed our duplex, quadruplex and multiplex telegraph systems. It furnished us with the means, in the form of an electric dynamo, for supplying an economical source of electrical energy. It demonstrated to us, by a multitude of devices, the way in which we might avail ourselves of such electrical energy for purposes of electrical illumination. It early showed us that prolonged service could be maintained by using carbons of large dimensions; later, it showed us prolonged service by means of two or more pairs of carbons in one structure at each lighting centre, each structure having a single pair of carbons, and so combined with an automatic switch that upon the consumption of the pair of carbons of the first set the current would be automatically transferred to the carbons of the second structure. Moreover, Europe disclosed a method of burning two or more lamps in the same circuit, and how to prolong the life of carbon pencils by coating them with metal. Thus the European electrical laboratory had, when the electric pioneer of this country—Mr. William Wallace—entered the field, supplied us all the essentials, which we were at liberty to modify and transpose for purposes of obtaining prolonged, uninterrupted illumination by means of the electric lamp."

### New Electric Locomotives.

At the Baldwin Locomotive Works draughtsmen are busy working upon plans for the trucks to be used with the new type of electric locomotives which the Baldwin-Westinghouse combination intends producing. A locomotive after the new design will be ready for inspection in about three weeks. Two trucks will be made—one for light work and elevated roads, the other for the heavier class of suburban traffic, suitable for hauling 12 or 15 cars. These trucks can, it is claimed, by fitting them with motors of different power, be made to serve all the requirements of electric roads, from the lightest elevated, with a maximum speed of 40 miles an hour, to the fastest suburban work of 90 miles an hour.

### The Washington-Baltimore Electric Railways.

The contract has been let for the construction of the Columbia & Maryland Electric Railway between Washington and Baltimore, and the specifications call for a double-track road with 85-pound steel rails, standard ties and stone ballast—identical construction with that employed by the Baltimore & Ohio and Pennsylvania railways. Heavy masonry bridges are to be constructed, and the whole road will be equipped as substantially as a steam railway. The contractors are also to build a branch road from Baltimore to Ellicott City, Md., a distance of about 10 miles. The aggregate cost of construction of both roads will be nearly $3,000,000.

There are to be two power stations, one on the Patapsco River and the other at Laurel, Md. The contracts for the overhead line construction and the rolling stock equipment have not yet been awarded. The motors used will be capable of maintaining a high rate of speed.

Messrs. Widener and Elkins, who are the leading promoters, have announced that it is their intention to make the road a through line between the two cities, and to have it enter into active competition with the steam roads. Fast time is to be made by trolley express trains, and the terminal facilities in both cities will be ample for a heavy traffic. The site for the Baltimore depot has been selected in the heart of the city, midway between the railway stations. Under the specifications the road is to be completed within a year.

A contract for a second electric road between Washington and Baltimore is now being negotiated in New York. The enterprise is backed by the Washington, Sandy Spring & Baltimore Electric Railway. Allston Gerry and Nathan G. Miller, of New York, and James B. Colegrove and George S. Chase, of Washington, will take $750,000 of bonds. The Sandy Springs route will develop a section not now reached by railways. The Columbia & Maryland line, on the other hand, has been surveyed with a view of running express trains between the two cities over the shortest possible route, in competition with the Pennsylvania and Baltimore & Ohio railways.

### The Cost of Producing Electrical Power.

Mr. G. J. Melms, director or the Frankfort (Germany) central station, writing in the London *Electrical Engineer*, says that the cost of producing a kw hour in a station that is in operation 24 hours per day should be divided into two parts: (1) interest on cost of plant, etc., depreciation, salaries, and that portion of the labor, water and coal used during the time of maximum load for lighting purposes, or say, in round figures, four hours per day; (2) the cost of coal, water and labor used during the balance of the day, or 20 hours. In this way the cost per kw hour under the conditions just mentioned depends upon the time of the day when it is produced; in Frankfort the cost per kw hour in Case 1 is about three to four times as great as in Case 2, due to the establishment charges being debited to the lighting period only.

For lighting purposes, the Frankfort station charges at the rate of 16 cents per kilowatt-hour, with discounts ranging from 5 per cent. to 30 per cent., according to the lamp-hours used during the year. The rate for power is 4 cents per kilowatt-hour, with discounts ranging from 5 per cent. to 25 per cent., according to the number of kilowatt-hours consumed per annum. The same station is also prepared to furnish power in large quantities—that is to say, 1,000,000 kw hours or more per annum—at the rate of 1.3 cents per kilowatt-hour, under the following conditions: The current to be supplied during the year, 24 hours per day, except during the months of November, December and January, when, at the option of the central station, it can be cut off during the time of maximum load—that is, from 4 p. m. to 8 p. m. At this rate, 1.3 cents per kilowatt-hour, Mr. Melms says there will still be a profit (assuming, of course, that the cost is figured on the basis of Case 2), with the added advantage of having a constant load upon the station.

### An Acetylene Standard of Light.

M. Violle, according to the London *Electrician*, has recently been engaged in a series of researches on acetylene which have led to the construction of a standard light. He burns acetylene under a somewhat strong pressure in a burner to which air has easy access, and which gives a broad flame. Before the flame he places a screen pierced with an opening of a given size, and in this way he considers that he has obtained a standard of light which for constancy, whiteness and brilliancy is comparable to his absolute platinum standard, and which ought, he thinks, make a safe and convenient secondary standard.

## The Lecture Theatre.*

In those early days when man first began to acknowledge the solidarity of the world and to appreciate the instruction conveyed in the conversation of his more experienced contemporaries, when books were rare, and the press undreamt of, the lecture was a most fitting means of imparting instruction. Even when printing had made the circulation of thought and learning more rapid, the price of books still left the lecture theatre an admirable and economical place for education, and a mass of notes was a valuable contribution to the student's scanty library; but in these days, when the thought and the accumulation of years of study may be bought for a few shillings, the lecture is an example of an absurd conservative adherence to an antique system which has long ceased to justify by results the favor with which it is received. When every professor publishes a text-book for the benefit of his students, containing all, or practically all, that he purposes to repeat to them during the session, and when even a superficial acquaintance with the leading journals would keep them more up to date than the interpolations in a stereotyped course of lectures do, we do not see why college authorities continue to include courses of lectures in the curriculum, and even rigidly insist upon regular attendance at them. That many professors consider their own lectures of such very little importance as to deliver them more from a sense of duty to the board than of utility to their hearers, is well known, and it is only natural to suppose that the discourses of their compeers are held in even less respect by them. The lecture is not even a satisfactory way of educating professors, to look at the subject from a Teutonic point of view. To go through the same matter in the same way, perhaps in the same words, year after year, without any clue to the real benefit that is being derived from it, is scarcely edifying to the speaker or the hearers. If the professors—we are now speaking of engineering colleges—mixed intimately with their pupils so as to gain a direct acquaintance with the difficulties which they have to face, and would take the trouble to discover whether their remarks are being appreciated at their real value or not, something useful might be done in the lecture theatre. As matters stand, however, the demonstrator is of far greater importance to the welfare of the student than the professor. To the demonstrator he talks on more equal terms, discusses his difficulties and ventilates his opinions. It is the demonstrator who assists him at his experiments, overlooks his drawings, checks his calculations, etc. It is to be regretted that his dignified position, or his avocations, render it impossible for the professor to mingle sufficiently intimately with his students to get some idea of their individuality.

It is a disadvantage attendant on all forms of education, and unfortunately so to a remarkable degree in technical education, that while it makes many parasites, if we may use the term, it only develops the individual characteristics of those who could in all probability succeed without its assistance. The ever increasing demand for the "ready reckoner" form of technical literature is sufficient proof of the parasitism to which we refer. The book that receives the most favor on the market is that which provides cut-and-dried formulæ for everything; it is time-saving, and therefore economical, but when science has brought the simplicity of formulæ to a little greater perfection, and art has consummated the calculating machine, mathematics will become abstruse learning, willingly given over to the lucubrations of misguided students! We have too many laws, that is the truth of the matter. "It is liberty, not law, that makes great men," as Schiller said, and though he spoke of ethical law, his observation applies equally to science. Whatever a man wants to know he should discover for himself. This continual drumming of first, second and third into the ears of drowsy students makes parrots, not men of them. If they are to be taught anything, teach them how to learn, and not how to be taught. If the laws of motion are to have any reality to them, show them how to find them out for themselves. Teach students to draw deductions, and you teach them to reason. Instil into them only other men's thoughts and other men's reasons, and you set their feet on the primrose way to ignorance. A good memory is in many cases the cloak of a poor intellect. Memory is not, as it is often taken to be, cleverness; it is the servant of ability. The wholesale dosing of roomsful of students with lecture matter is not a good means of imparting instruction. An attempt should be made to draw out the individuality and personality of each student, a fact which Prof. Herkomer has fully recognized, and uses with success in his art school.

We ask, it will be said, for an impossibility. We admit that such is the case under the existing ridiculous conditions. Education is a great deal too cheap to be good. The number of students is entirely out of proportion to the number of instructors. The instruction is such that it develops the memory at the expense of the intelligence. It will be urged that we have lost sight of the benefits derived from the laboratory and the college workshop. By no means. We have studied both. In the former, except in isolated cases, the student is expected to complete an experiment in as many hours as there should be days. He is given a card of instructions, and follows them mechanically; he is marked by his results, and if he cannot get satisfaction from his instrument, he cooks the figures; the law that he should deduce is put in italics under his nose; he knows what the results should be before he commences observation; finally, he is not always honest, and one demonstrator is responsible for perhaps thirty to forty students. The college workshops are comparatively pleasant as a playground, fairly useful as an advertisement, occasionally handy for repairs, eminently useless for instruction. We are not dealing with these matters now, or we would justify our hard sayings. Our object is to call attention to the misdirection of energy in the lecture theatre, and to put forward the proposition that the aim of technical education should be to draw out and develop the natural abilities of students, not to coach them for examinations nor to lay snares to draw them into the seductive slough of parasitism.

* From the London *Engineer*.

## Critical Condition of Tesla.

Our readers, says the London *Electrical Review*, will be grieved to learn, on the authority of Mrs. Bloomfield Moore, in the *New Science Review*, that Mr. Tesla is in a very awkward position. It is a number of days, says this gifted woman, since Tesla crossed the border line of the circle in which other electricians are working, but he still remains in the interatomic field of research, unmindful of the triple conditions that govern electricity in the relation which it sustains to the first order of the "luminous." This is sad enough, but we have yet to tell the worst. It appears that by reason of Tesla's wicked neglect of Keely's system of resonance he has missed the chance of hobnobbing with electrical phenomena in the sympathetic field, and is standing on a bridge which connects the primary two thirds of the electric stream—the subdominant current with the dominant. What a fearsome post is his! But the consequences of his folly will still pursue him, and even though he may hook on to the dominant, he will still be subserved to the terrestrial neutral far in the rear of sympathetic union to radiating celestial outreach, the connecting link of which exists in the interluminous. Mrs. Moore says, further, that even in the event of Tesla's salvation, he will not have reached the compound interetheric. If such be the case, we should advise Mr. Tesla to climb down at once from his supradominant hypoluminous outreachment, and no longer seek to attain the interatomic realm, but content himself with hard pan. The sting of Mrs. Moore, however, in her—well, our readers will understand. Given a prompt cash settlement, and Keely will plank down all his secrets, and tell us how we may make a ten-thousand-ton ship float like a gossamer in the summer breeze. (Our readers will kindly take notice that this last poetic vein is our own, not Mrs. Moore's.) Failing this settlement they will die with Keely. The cosmical law of sympathetic association will then be lost to the cold world, and Keely will rise on vibratory mediums into the far outreach after a life spent in overreaching, amongst others, Mrs. Moore.

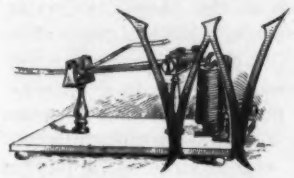
## Professional Papers.

An engineering journal, in a revolutionary moment, recently propounded the startling doctrine that the lecture was "an example of an absurd conservative adherence to an antique system." Emboldened by the example of our staid contemporary, we venture, not for the first time, to apply much the same language to the system of reading papers, which still holds its own. The absurdity of the custom has been frequently exposed in these columns, and the Institution of Electrical Engineers might for once lead the way in so sensible a reform. Papers are presumably intended to be both sunderstood and discussed. How can either end be obtained by the authors getting up and running through their papers with lightning-like rapidity and irritating inaudibility, and then sitting down with a satisfied sigh to await the comments of the audience, the majority of whom have never seen the papers in print, and even the more favored of whom have probably received them without diagrams and only a day or two before the date of reading?—*London Electrician.*

## The Invention of the Electromagnetic Telegraph.—II.

BY FRANKLIN L. POPE.

VAIL ASSERTS HIS CLAIM TO THE STYLUS AND GROOVED ROLLER.



RITING to Mr. Kendall, under date of Oct. 7, 1852, Vail says:

"I took hold of the telegraph in its infancy, and when the world was laughing at it and the inventor to scorn. By mismanagement or misfortune I have the smallest mite in the concern, and am prohibited from holding any lucrative office in it, because I, in its early development, hazarded it my assistance. Even some portions of the telegraph which I invented have never been publicly accorded to me, viz.: *the mode of recording by the indentation of paper under a grooved roller* by means of a steel point on the end of the armature lever playing upon the paper over the groove, and which invention of mine has been universally adopted and used."

In his reply, dated Oct. 16, 1852, Mr. Kendall says:

"I take it for granted that what you say about justice not having been done to you in some parts of the telegraph machinery, you do not mean that there is anything unexplained which would legally affect the validity of Morse's patent; yet if you were to publish or make known to our adversaries what you say to me, they would seize hold of it and exercise their utmost ingenuity to give it weight before the courts, in the hope of destroying, not only your property in the patents, but that of multitudes of others."

To this Vail responded as follows:

"In regard to my mode of marking by the indentation of paper by the steel point, which I invented and applied as mentioned in my former letter, you have wholly mistaken my expression and design in mentioning it as I did, which was not to injure the telegraph interest nor to deceive you; notwithstanding you have undertaken to exhibit a very frightful picture of imaginary evils which the general publicity of the fact might produce, that you should have inferred from what I stated that I had duped and defrauded you and all others to whom the patent right to use Morse's telegraph had been sold. . . . Now I have simply to speak out frankly and fearlessly and state to you *that I did invent* what I stated in a former letter to have invented, and that I never refrained from stating it anywhere and everywhere, whenever or wherever I thought of it or had occasion to do so, not for the sake of boasting, but as a simple truth which may be spoken and, in this case, ought to be spoken. I have never announced it in the public papers. I, however, informed you of the fact of its being my invention as soon as I became acquainted with you. Knowing it to be true, I would not state less or more than the truth. The whole value of the telegraph is not enough to induce me to say less or more, and the renown of the world I trust has no greater power. Now, admitting I invented it, you could, I think, have never read my agreement with Prof. Morse, by which I became a joint owner with him in the patent-right. If you had, to the purpose, you would not have written me as you have, and you would have there found that whatever Mr. Smith, Dr. Gale or myself should invent or discover going to simplify or improve Morse's telegraph would belong to all jointly, and become a part of the original invention.* I could not therefore have taken out a patent for this invention myself. Yet this agreement with Morse and others does not refuse me the *honor* of being the inventor of anything I did invent. Else why was it not specified in the agreement? It supposed I might make or invent improvements in the telegraph; it does not refuse me the honor but denies me the exclusive right to ownership in such improvement. Yet the agreement is such that it makes the invention a unity and the property of the patentees under Prof. Morse. So it was intended and such is its power. That agreement is open to all who choose to read it, for, if I mistake not, it is on the public records. Now, what was it that I was contending for? Simply that I might have what had never been given me, a public acknowledgment of what is in universal use, and has been from the first wherever Prof. Morse's invention is used. Under the circumstances would that invalidate the patent and brand me as a fraudulent man? Can you tell me when and where I have been guilty of any such act? Have I not always resisted it in others? Again I repeat, I am very sorry that you should have permitted yourself to suppose I could be guilty of such a thought. . . . Where is the harm of its public announcement, since it is but the truth? It has already been told to many since its invention and application. Still, I do not pertinaciously insist upon its publication, although I have been urged to have it published by others, time and again. I care little for the world's applause, which at best is very hard to maintain, even when justly one's due, and given often where they can not and will not truly discriminate and justly award. But what I do desire is truth in relation to the history of the improvements in the magnetic telegraph, and such equal chances among those with whom I am copartner as may be equivalent to the risk I have run, the interest I have shown, and improvements I have made in the enterprise."

PROF. LEONARD D. GALE.

When Alfred Vail had been 12 years in his grave, a member of his family, in removing from its accustomed place one of the instruments used on the original Baltimore-Washington line in 1844, and which had been carefully preserved as a family heirloom, discovered for the first time a folded paper which had been attached underneath the instrument, on which was written, with a lead pencil, the following words:

"This lever & roller were inv[ented by me in] the 6th story of the New York *Ob[server* office] in 1844 before we put up the Telegr[aph line] between Wash & Balt & thi[s . . . . . ] has been always used in Morses instrum[ent]. I am the sole & only inventor of this mode of telegraph embossed writing. Prof. Morse gave me no clue to it or did any one else & I have not asserted publicly my right as first & sole inventor because I wished to preserve the peaceful unity of the invention & because I could not according to my contract with Prof. Morse have got a patent from it.

"ALFRED VAIL."

(Words enclosed in brackets have been torn off.)

WHY VAIL'S CLAIMS WERE SUPPRESSED DURING HIS LIFETIME.

Assuming the facts as to the origin of this invention of the marking style and grooved roller to be as stated in the most unequivocal and positive terms by Vail, it is not difficult to understand why his claims for public recognition of those facts should be as far as possible suppressed by his associates in the ownership of the patents. Morse's subsidiary patent of April 11, 1846, reissued in 1848, contained among others, the following claim:

"Third. I also claim as my invention, the combination of the point or points of the pen and pen-lever or its equivalent, with the grooved roller or other equivalent device, over which the paper or other material suitable for marking upon may be made to pass for the purpose of receiving the impression of the characters; by which means I am enabled to mark or print signs or signals upon paper or other fabric by *indentation*, thus dispensing with the use of coloring matter for marking, as specified in my patent of Jan. 15, 1846."

Not only did Morse, in his application for this patent, make solemn oath that he believed himself to be the original and first inventor of this combination, but he has made the same assertion, in substance, on many other occasions, though usually in carefully guarded language. In 1867, he wrote:

"There were many modes of marking which I devised and tried, but experience alone could settle which was best; the pencil and pen and small printing-wheel with ink were the original modes in use; the steel point for embossing the character was invented some time after and patented as an improvement, since it dispensed with ink."†

Substantially the same statement is repeated in a later publication—an official report to the Government of the United States. After referring to the defective results arising from the attempts to use ink for marking, he says:

* "And it is hereby further agreed between the said parties of the first [Morse] and the second [Vail] that in case either of them should make any new discoveries which would be applicable to said telegraph, or any new invention which will tend toward perfecting the same in any manner, that he will as soon as practicable communicate the same to the other and it shall be held as the property of each in the same proportion as their respective right in the whole, and the expenses of taking out letters-patent for such new discovery or invention, if such letters-patent be mutually thought to be necessary, shall be defrayed by each in the same proportion as they hold of the whole by these presents hereinafter mentioned." (Contract between Morse and Vail executed Sept. 23, 1837.)

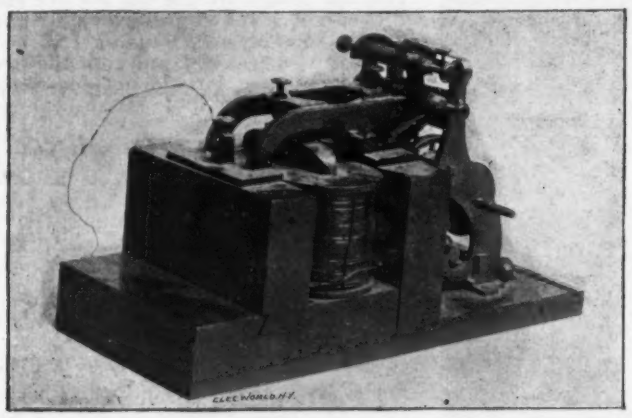
† "Modern Telegraphy," Paris, 1867, p. 48.

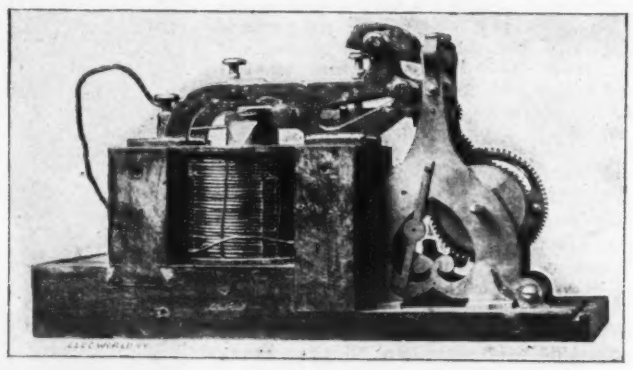
"To avoid these inconveniences a steel point (point sèche) was devised and used which marked the paper strip by the interposition of a blackened or colored paper between the point and the paper-strip. . . . This also was successful, but did not remove every inconvenience. It was then that the idea of embossing the paper directly by the same stylus, in the mode now known as the dry-point or embosser (the point sèche) was conceived and adopted. This was considered by him (Morse) a substantial improvement, since the simple stylus at the extremity of the lever was always in order, requiring no attention. It dispensed with ink and all its inconveniences, and reduced the apparatus to the minimum of simplicity."

In a letter dated New York, June 17, 1843, to F. O. J. Smith, Morse claims for himself, in the most explicit terms, the credit of an improvement which is apparently none other than the stylus and grooved roller. He says:

"I have made a most important simplification in my Register by which I dispense with ink altogether, and have no difficulty in writing beautifully without attendance for a whole day together, if not for a week."

The whole conduct of Prof. Morse in relation to this matter of the invention of the stylus and grooved roller seems inexplicable. Under the terms of the contract existing between himself and Vail, the latter was necessarily precluded from receiving a patent for his improvement, but the proper course was for Vail to make application for the patent, accompanied by a request to the Patent Office to issue it to the legal owners of the original Morse patents, a straightforward, just and honorable procedure, which would have avoided all complications. By preferring the alternative he did, that of claiming it as of his own individual invention, Morse exposed himself and his associates to imminent danger of having the entire invention practically thrown open to the world. If Vail had published himself as the inventor of the embossing register,





Register Used on Baltimore-Washington Line, 1844.

and the opponents of Morse had then compelled him to go on the witness stand and testify to the facts, it would have placed the Morse patentees in a most unpleasant predicament.

### Invention of the Alphabetical Dot-and-Line Code.

In an article published some years since, the writer said:

"The crucible of time alone has the power to separate the permanent and the essential from the transient and the non-essential. . . . This simple apparatus (the battery, key, line, and sounder) comprises all that is essential in the commercial operation of the electric telegraph. Other attachments are added for convenience, especially the relay and combined circuit for increasing the volume of sound from the receiving instrument; but this feature is in no wise indispensable and is often omitted. This elementary mechanism and the alphabetical code of Vail, based on the immutable principle of the division of time and space, are essentials; all else is in a greater or less degree superfluous. . . . Not a single feature of the original invention of Morse, as formulated in his caveat and repeated in his original patent, is to be found among the *essential* constituents of the modern apparatus. . . . The elements contributed by Morse have gradually fallen into desuetude, so that the essential telegraph of to-day and the universal telegraph of the future comprises solely the work of Joseph Henry and Alfred Vail. The grandeur of Vail's conception of an alphabetical code based on the elements of time and space has never met with the appreciation which it deserves. . . . Indeed, with a charged electrical conductor, and a knowledge of Vail's alphabetical code, even the transmitting and receiving instruments of the electric telegraph may be dispensed with in emergencies."*

This statement has been criticised by an authority whose opinion is entitled to respectful attention, as "preposterous," while another prominent telegraphic historian, who may be presumed to be perfectly familiar with all the facts, says of Alfred Vail "who has of late years been held up as the true parent of the telegraph" that "he simply hired himself at three dollars a day to put into mechanical shape and workable form the already completed and successfully and publicly exhibited mechanism of the Morse telegraph. There was nothing left to invent" How much basis of truth there is in the last quoted assertion, I am willing to leave the unprejudiced reader of what has heretofore been set down to determine. As to the opinion first quoted, it can only be said that it seems impossible to deny that if Joseph Henry had applied the alphabetical telegraphic code of to-day to the organization of apparatus invented and publicly exhibited and operated by him in 1831, it might be affirmed with absolute truth, that so far at least as fundamentals were concerned, there would have been "*nothing left to invent.*" The whole question therefore depends upon the result of the inquiry: "To whom is due the credit of the application of an *alphabetical code of signals* to the apparatus actually existing on Sept. 2, 1838?"

This alphabetical code is distinctly claimed by Morse in the reissue of 1848 of his patent of June 20, 1840, for which the original application was filed on April 7, 1838, in the following words:

"Fifthly. I claim as my invention, the system of signs, consisting of dots and spaces, and of dots, spaces, and horizontal lines, for numerals, *letters, words and sentences*, substantially as herein set forth and illustrated, for telegraphic purposes."

And in Vail's own book (p. 30) he says:

"This *conventional alphabet* was originated on board the packet *Sully, by Prof. Morse*, the very first elements of the invention, and arose from the necessity of the case; the motion produced by the magnet being limited to a single action."

Now it is as clearly established by circumstantial evidence as anything well can be, that the code originated by Morse on board the *Sully* was *not* alphabetical, but *numerical;* a most important distinction, and one which must be insisted upon as making all the difference between a code of *universal* application and one whose application is extremely *limited* in its scope. Among the diagrams in Morse's sketch-book made on board the *Sully* in 1832, are characters representing the nine digits and a cipher, each composed of dots, or dots in combination with a line (see *ante* p. 131), but in no one of his sketches, letters, and experiments, from that date until nearly the end of 1837, do we find the slightest hint of the possibility of an *alphabetical code*, or of any plan other than the old and well-known numerical code of the semaphoric visual telegraph. Early in September, 1837, Vail commenced work at Speedwell on the new instruments, and on Oct. 24, Morse writes Vail from New York:

"The dictionary is at last done. You cannot conceive how much labor there has been, but it is accomplished, and now *we can talk or write anything by numbers.*"

### Substitution of the Alphabetical for the Numerical Code.

So late as Jan. 11, 1838, the exhibition given at Morristown, heretofore referred to, was made with the aid of the numerical code. The first distinct reference to the alphabetical code is found in a statement published in the New York *Journal of Commerce* of Jan. 29, 1838, as follows:

"Prof. Morse has recently improved on his mode of marking by which he can dispense altogether with the telegraphic dictionary, *using letters instead of numbers;* and he can transmit 10 words per minute, which is more than double the number which can be transmitted by means of the dictionary."

This apparently fixes the date of the invention, or at least the application, of the alphabetical code, at a date between Jan. 11 and 29, 1838.

*"American Inventors of the Telegraph," *Century Magazine*, xxxv., 943, April, 1888.

William Baxter, a noted inventor, now dead, who worked at Speedwell as an assistant of Alfred Vail, made in his lifetime a written statement from which the following is extracted:

"We constructed the new lever, and thus for the first time produced a register capable of making dots, dashes and spaces. .. . . He [Vail] saw in these new characters the elements of an *alphabetical code* by which language could be telegraphically transmitted in *actual words and sentences*, and he instantly set himself at work to produce such a code. His general plan was to employ the simplest and shortest combinations to represent the most frequently recurring letters of the English alphabet, and the remainder for the more infrequent ones. After going through a computation to ascertain the relative frequency of the letters, . . . he was seized with a sudden inspiration, and visited the office of the Morristown local newspaper, where he found the whole problem worked out for him in the type-cases of the compositors. In this statement I have given the true origin of the misnamed 'Morse' alphabet, the very foundation and corner-stone of a new system, which has since become the universal telegraphic language of the world."

The late Moses S. Beach, then editor of the New York *Sun*, in the issue of that journal of Sept. 25, 1858, under the title of "Honor to Whom Honor is Due," says:

"Alfred Vail entered into these experiments with his whole soul, and to him is Prof. Morse indebted, quite as much as to his own wit, for his ultimate triumph. *He it was who invented the far-famed alphabet;* and he, too, was the inventor of the instrument which bears Morse's name. But whatever he did or contrived went cheerfully to the great end."

In a private letter subsequently written by Mr. Beach, and quoted in W. B. Taylor's *Henry and the Telegraph*, p. 85 (note), he said:

"I was then personally acquainted with the Vails, and a not infrequent visitor at the homestead in Morristown; besides of course having a personal acquaintance with Prof. Morse, and with the telegraph managers generally. My impression is that the article was at the time approved for its exact statement—*never controverted.*"

Mr. Beach's article, it will be observed, was published in the lifetime of Alfred Vail as well as that of Prof. Morse, and if the statements made therein were without foundation, it is at least singular that they were not at the time called in question, either by Prof. Morse or his friends.

There is probably now no living witness who can testify as to the actual facts in the case. I do not hesitate to express my conviction from the evidence which I have been able to collect and present, that the *alphabetical* as distinguished from the *numerical* telegraphic code was originated and applied to the telegraph in the latter part of January, 1838, by Alfred Vail.

### THE FINGER-KEY CLAIMED BY VAIL.

In reference to the invention of the finger key, which was substituted for the port-rule at an early period in the course of experimental operations during the construction of the Baltimore-Washington line, Thomas C. Avery, a philosophical instrument-maker of New York, testified in the suit of French v. Rogers, that the key first used was a rude affair consisting of a strip of sheet-copper with one end fastened to the table, while the other, being loose, moved like a spring. Avery says:

"I invented and made a finger-key with a spring and fulcrum for breaking and closing the circuit of conductors, the construction of which was my invention; the finger knob was made of ivory or pearl for insulating the key to prevent the electric shock."*

This claim is explicitly denied by Vail, who, in a letter written to Morse (of which the date is missing, but which was probably about 1853,) accompanying some relics of the early experimental work in which they had been mutually engaged, says:

"I also send you one of the finger-keys which I had made in Washington immediately after the opening of the telegraph between Washington and Baltimore, *and which Avery has sworn falsely to have suggested to me.* I can only say that he did not suggest any kind of key to me; I told him how I wanted him to fix up one for me. I, while at Baltimore, changed from dipping the wire to a spring key, one something like which I have, and you will find it in the box. The earlier key is the lightest, and the Washington key is heavier."

### VAIL'S TELEGRAPHIC INVENTIONS SUMMARIZED.

It would appear, therefore, that Vail's contributions to the perfection of the invention may be summed up in claims something like the following:

1. An electromagnet, armature and retractor, in combination with a point or style, a roller moved by clockwork provided with a circumferential groove for receiving the point of the style, and a strip of paper passing over said roller beneath the said point.

2. An electromagnet, armature and retractor, in combination with adjustable stops for limiting the movement of said armature in each direction.

3. An alphabetical code in which each letter is represented by one or more of four elements, viz.: a short line or dot; a longer line, or dash; a space corresponding in length to the dot and a space corresponding in length to the dash.

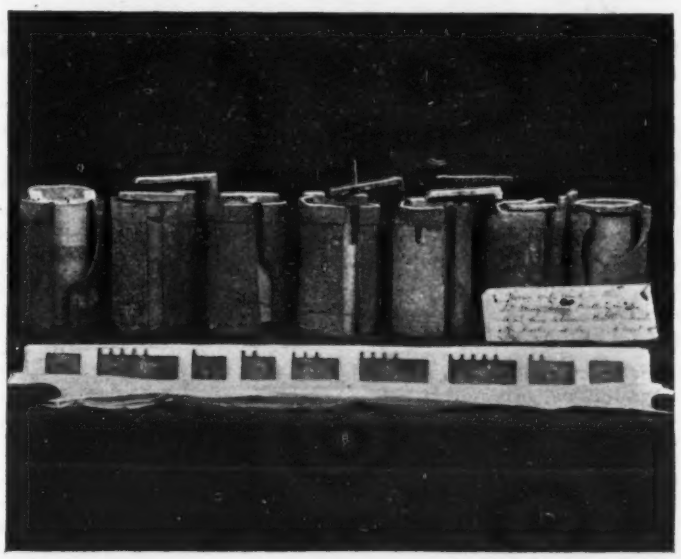
4. A transmitting key comprising a rigid horizontal lever vertically movable upon a rigid transverse axis, and having a finger-knob at one end, in combination with a contact-point affixed thereto, an insulated anvil against which said contact-point impinges when the lever is depressed by the knob, and a retractor for separating the contact-point from the anvil when the pressure upon the knob is relaxed.

5. A transmitting key comprising a rigid horizontal lever vertically movable upon a rigid transverse axis, in combination with an adjustable stop for limiting the movement of the lever in each direction.

* For other testimony of Avery see Mr. Jones's article, p. 108, ante.

### CORNELL'S INVENTION OF THE INVERTED CUP INSULATOR.

There remains one more important contribution to the perfection of the early telegraph which should not be passed over without notice. Ezra Cornell was employed in 1843 by F. O. J. Smith to invent and construct a plow for burying the proposed subterranean wires. After the failure of this plan in the Winter of 1843-44, Morse appointed him his mechanical assistant. In February it was decided to place the wires on poles, and on the 1st of April the stringing of wires was commenced at Washington under Cornell's



GROVE BATTERY USED ON BALTIMORE WASHINGTON LINE, 1844, AND SPECIMENS OF TYPE MADE BY MORSE IN 1832.

direction. He devised the insulating attachments of the first line, which were merely two flat horizontal plates of glass between which the wire was held and covered with a wooden roof. In 1845, Cornell erected a section of the New York and Philadelphia line between Somerville, N. J., and the Hudson River, using a "bureau-knob" insulator of glass of his own design. This was a vast improvement over its predecessor, which he followed in 1847 by the inverted-cup or "petticoat" insulator, a type largely used even at the present day. So we may credit Ezra Cornell with the following claim:

An insulating support for telegraph lines, of molded glass in the form of an inverted cup, and provided with a circumferential groove to which the line is secured by an encircling tie-wire, and a cylindrical socket for receiving an upright pin or support.

### CONTROVERSY BETWEEN MORSE AND HENRY.

It is necessary to make some reference to an unfortunate and apparently needless controversy which arose between Prof. Morse and Prof. Henry, growing out of the telegraph litigation. The acquaintance between the two commenced in May, 1839, and from that time until 1845, Henry, from time to time, imparted to Morse scientific information bearing on the subject of his work. In 1845, during Morse's absence in Europe, Alfred Vail published his well-known work on the telegraph, in which scant reference was made to Henry's discoveries. Henry expressed to a mutual friend some dissatisfaction in reference to the matter, and for reasons which do

not now appear, seems to have held Morse responsible for the omission. Learning of this dissatisfaction, Vail wrote a most courteous letter to Henry, apologizing for any injustice he might unwittingly have done him, and requesting that any errors of omission or commission might be pointed out for correction in a subsequent edition; stating at the same time that Morse was in no manner responsible in the premises, as he had never seen that portion of the work until it was in print. To this letter, as Henry afterward testified, he "did not think fit to make any reply," an act of apparent discourtesy which is so unlike Henry's usual considerate conduct in such matters, as to be difficult of satisfactory explanation. A few months later Morse also wrote Henry on the same subject, expressing in the most friendly terms his deep regret that any misunderstanding should have occurred, and desiring to be made acquainted with the source of the trouble, that he might make any possible amends. Henry briefly acknowledged the receipt of this letter, but seems to have made no further written reply. In 1848, Morse wrote to Sears C. Walker in reference to a paper on the "Theory of Morse's Electromagnetic Telegraph" which the latter had prepared for publication, and said:

"The allusion you make to 'the helix of a soft-iron magnet prepared after the manner first pointed out by Prof. Henry, gives me an opportunity, of which I gladly avail myself, to say that I think justice has not hitherto been done, either in Europe or this country, for the discovery of a scientific fact, which in its bearing on telegraphs—whether of the magnetic needle or electromagnet order—is of the greatest importance. . . . To Prof. Henry is unquestionably due the discovery of a fact in science which proves the practicability of exciting magnetism through a long coil at a distance, either to deflect a needle or magnetize soft iron."

In a note to Mr. Walker, Morse requested that this letter be first shown to Henry for approval and criticism, and then published as a note or appendix to his paper. It appears that it was so shown to Henry, but it was not published by Mr. Walker with his paper, nor was any explanation, so far as appears, ever vouchsafed for the omission. In 1849, Henry was compelled by subpœna to give testimony in Boston on behalf of the defendant in the Supreme Court case of Morse v. O'Reilly. While his testimony certainly does not evince a particularly cordial feeling toward Morse, it is entirely evident that it was his intention and desire, as he himself afterward said, to render him "full and scrupulous justice" in every statement which he made. Among other questions put to Henry was the following:

"*Q.* State also what principles used in the telegraph are, so far as you know, original with Prof. Morse?

"*A.* I am not aware that Mr. Morse ever made a single original discovery in electricity, magnetism or electromagnetism, applicable to the invention of the telegraph. I have always considered his merit to consist in combining and applying the discoveries of others in the invention of a particular instrument and process for telegraphic purposes. I have no means of determining how far this invention is original with himself, or how much is due to those associated with him."

Whatever cause Henry may have had for his feelings toward Morse, it is clear that it exercised no adverse influence upon the character of his deposition, for it will be noted that he carefully refrained from the slightest allusion to his Albany experiment of 1831, in which acoustic signals had been transmitted through a mile of wire, but of which no account had at that time been published. Had he done so, and had others then living and familiar with the circumstances been brought forward to corroborate Henry, the result would inevitably have proved fatal to Morse's claim to the process of producing sound-signals at a distance by electromagnetism, and would have virtually thrown the whole invention open to the public, a result which Henry could not but have foreseen. Not only this, but in the early part of 1854, when application was made by the Morse patentees for an extension for seven years of the patent of 1840, Henry was consulted by the Commissioner of Patents in reference to the propriety of granting the extension, as appears by a letter from Hon. Charles Mason (the then Commissioner) to Henry, under date of March 31, 1856; from which the following is an extract:

"Some two years since, when an application was made for the extension of Prof. Morse's patent, I was for some time in doubt as to the propriety of making that extension. Under these circumstances I consulted with several persons, and among others with yourself, with a view particularly to ascertain the amount of invention fairly due to Prof. Morse. The result of my inquiries was such as to induce me to grant the extension. I will further say that this was in accordance with your express recommendation, and that I was probably more influenced by this recommendation and the information I obtained from you than by any other circumstance in coming to that conclusion."*

On Dec. 27, 1854, shortly after the extension above referred to had been granted, Col. Tal. P. Shaffner, who on this as on a subsequent occasion to which allusion has already been made, certainly manifested a good deal more zeal than discretion, wrote to Morse requesting him to make what he termed an "expose" of "Prof. Henry's claims to the invention of the electromagnetic telegraph"; claims which, by the way, Henry had not only never made, but which, as we have seen, he had assisted Morse in maintaining in his own behalf. To this Morse replied two days later enclosing a long article, which it seems he had prepared in advance in December, 1853, which was printed and widely circulated by Shaffner in his *Telegraph Companion* of January, 1854, filling nearly 100 octavo pages of that periodical. It was entitled "A Defence Against the Injurious Deductions Drawn from the Deposition of Prof. Joseph Henry in the Several Telegraph Suits; with a Critical Review of said Deposition and an Examination of Prof. Henry's alleged Discoveries Bearing upon the Electromagnetic Telegraph."

The publication of this ill-advised attack upon Prof. Henry can only be regarded as a most unfortunate error of judgment on the part of Prof. Morse, inasmuch as everything we know of his character forbids the suggestion that it could have originated in his mind in any other way than through the mercenary inspiration of interested capitalists and assignees, determined to expand the monopoly of telegraphic communication to its utmost possible limit. It exhibited all the literary and controversial skill of which Morse was admittedly an accomplished master, but can nevertheless only be characterized as a most unwarrantable aspersion of the character of Henry; an impeachment of his credibility as a witness and his integrity as a man. Even the originality of his discoveries was denied, and their importance belittled. Prof. Henry felt deeply grieved at this apparently wanton and unprovoked arraignment of his character and laid the matter before the Board of Regents of the Smithsonian Institution, of which he was then secretary. A select committee of investigation was appointed which carefully went over the whole matter. Its report, which completely exonerates Prof. Henry, was unanimously adopted by the Board of Regents on May 19, 1858, and appears to have terminated this much-to-be-regretted controversy.†

### SUMMARY OF THE EVIDENCE AS PRESENTED.

The conclusions which may be drawn from the lengthy review which has been given of the history of the invention of the electromagnetic telegraph, as they present themselves to my mind, may be briefly summed up as follows:

1. The first electromagnetic apparatus for producing at will audible sounds at a distance, was invented, constructed and operated by Joseph Henry in Albany, N. Y., in 1831.

2. The first electromagnetic telegraph for producing at will permanent written marks at a distance, was invented by Prof. S. F. B. Morse in 1832, and constructed and operated by him in New York prior to Sept. 2, 1837.

3. The first code of numerical conventional signs capable of being intelligibly written or sounded by the armature of an electromagnet, was originated by Morse in 1832.

4. The first code of alphabetical conventional signs capable of being intelligibly written or sounded by the armature of an electromagnet was originated by Alfred Vail in 1837-38.

5. The relay and combined circuits was invented by Morse prior to Sept. 4, 1837.

6. The lever-key in its modern form, was invented by Vail in 1844.

7. The dry-point recording register was invented by Vail in 1843.

8. The inverted cup of glass for insulating the line wire was invented by Ezra Cornell, in 1844-45.

It may be that other documents, in existence and hitherto unknown to historians, may come to light in future years, which will materially change the aspect of the question as it appears at the present time, but it has been my desire and intention in what I have here written, in the words of Henry, to render according to the present evidence scrupulous and exact justice to all who were concerned in the invention of the electromagnetic telegraph. The development of this wonderful agency has been from first to last a characteristic and typical example of the great law of evolution, beginning with

* In this connection see Mr. Jones' article, ante.

† Smithsonian Report for 1857, pp. 88-98.

**Henry's apparatus of 1831, and ending, at least until a recent date, with the familiar key and sounder of modern telegraphy. The work of Morse marks only an important and indispensable era in this process of evolution, not its ultimate conclusion, as many writers seem to have somewhat hastily assumed. Yet, in the gradually increasing use of the automatic system of transmission, probably destined to become universal in the future, we may recognize the possibility of a complete reversion to the original scheme of Morse, in which the alphabetical code will be the sole survivor among the contributions of others than himself to the general result.**

## The Telephone Monopoly and Subverted Patent Law.

BY E. B. FROST.

The original Bell telephone patent claimed the transmission of speech by means of a current of electricity undulated similarly in form to sound waves in air, and on this claim was based the monopoly of the telephone during its life. This claim, as interpreted by the courts, dominated every form of instrumentality, discovered or undiscovered, which should, in its operation, undulate a current of electricity similarly in form to sound waves in air. This patent described one mechanism by which speech might be transmitted by means of a current of electricity. It also disclosed a theory of the physical laws involved in the operation of the mechanism and, moreover, declared this theory to be the essential law of the electrical transmission of speech. This law, this essential principle, was not the claim in itself, but only in so far as it was the method essential to the electrical transmission of speech. The transmission of speech by electricity was not claimed ; nor was the undulating of a current of electricity in form similar to sound waves in air. In other words, it was not a patent for the fact nor for the principle, but for the application or utilization of this principle in the achievement of the fact. The undulation of the electric current similarly in form to sound waves in air declared as the essential principle, the law of the electrical transmission of speech was, while a brilliant conception, a mere assumption; an assumed law never proved; an assumed law which the Bell Company was never called upon to prove; an assumed law whose recognition by the courts threw the onus of disproof on its opponents; an assumed law upheld by the Supreme Court of the United States as the true theory of, and essential to, the electrical transmission of speech. No one has yet denied that, so far as discovered, every electrical transmission of speech is accomplished by one and the same law. It was easy for the Bell Company to prove any competing instrument to be operative in exactly the same manner as were the Bell instruments operative. This true, and the assumed theory of Bell held as the law essential to the electrical transmission of speech, infringement of the Bell patent was consequently adjudged. This procedure, based on this assumption, secured the Bell Company in its monopoly of the telephone interests, since there had been no question raised as to the validity of the Bell patent if the theory were true.

It was tacitly conceded that were the Bell theory true, he or his assignees should have exclusive right to the electrical transmission of speech during the life of the patent.

Again, in 1891, there was issued to the same corporation—the American Bell Company—a patent granted to Emile Berliner for a microphone which claims as essential to the microphonic transmission of speech the constant contact between electrodes. This patent is to dominate all microphones already discovered or to be discovered which shall employ constant contact between electrodes, since by tacit concession the Bell Company shall have exclusive right to microphones employing constant contact between electrodes in the electrical transmission of speech. On the concession of this right is to be based the continuance of the telephone monopoly.

The object of this argument is to combat this concession by showing that such concession is illegal in that it subverts the United States patent law.

This tacit concession renders the above patents exclusive, since all telephonic transmission of speech was held subservient to the Bell patent during its life, excluding all other patentees whomsoever the Bell Company chose to exclude; since all microphonic transmission or speech is now held to be subservient to the Berliner patent during its life, excluding all other patentees whomsoever the Bell Company shall choose to exclude.

This exclusion, based on this concession, is a denial of the rights of other patentees in that it has been exercised to withhold from an inventor the right to the use of his respective invention. For example: one Prof. Dolbear invented a telephone which was wholly unconceived of by the Bell patent, and yet the exercise of the exclusive right to the Bell patent militated against Dolbear's exclusive right in that it denied him all right to use his invention. There is no question but that Dolbear really invented something to which he was entitled to protection in his exclusive right to use the same under the patent law; but, nevertheless, it falls out that the law is of no worth to secure to him the value of his invention. In fact, his patent is still-born.

Again, this exclusion, based on this concession, is a denial of the rights of the people at large, in that the contract as per patent is abrogated ; in that they are denied the benefits of the use of, for instance, the Dolbear invention ; in that they are denied the benefits of competition.

The exercise of the exclusive right as practiced by the Bell Company is a prejudgment of the acts of the United States Patent Office in the issue of patent rights, for it arrogates to itself the power to declare that a privilege granted by the United States shall be no privilege. The United States Patent Office said that Dolbear's patent should be a privilege to him. The Bell Company set aside the grant by declaring that the Dolbear patent should be no privilege, the government to the contrary notwithstanding.

The several telephone cases having been decided, and the Bell Company's position of exclusion having been tacitly conceded, the United States Patent Office was fully aware that each and every privilege which they should and did thereafter grant by patent to telephone patentees would be valueless by reason of the superior power of the Bell Company to review and judge governmental acts. Yet the Patent Office, knowing them to be valueless, continued to grant privileges, declaring them to be of value, and for which they received money in the manner of fees. Every fee so received was no more nor less than the receiving of money under false pretense.

Since the decision of the Berliner case by the United States Circuit Court of Appeals, the Patent Office has continued to grant privileges, receiving fees under the same false pretense. Moreover, many grants of privileges by the time of the expiration of the Berliner 1891 patent will have been born—still-born—have existed as dead issues, and have ceased to exist as such. Is the government, when the superior power of the Bell Company shall have ceased to exist, prepared to then say that the still-born grants issued shall then have life and thus redeem its contracts?

The result of the assumed and tacitly conceded right to the Bell Company has been the withholding from the public of the benefits of the progress of the art and science of telephony, for the public has been compelled to use inferior instruments when competition would have given them superior. Another result has been the impeding of progress in the art and science of telephony, since inventors have had no opportunity to develop, by the knowledge of actual experience of their inventions, the science and art involved.

The miscarriage of the intent and purpose of the United States patent law resulting from the exclusive concession will be most strikingly paralleled by an illustrative supposable case, which we might call the wheelbarrow case.

Let us suppose that the principle of the wheel was unknown previous to the patent application of a certain Mr. A for a vehicle, his particular invention being the wheelbarrow. Let him claim, not the wheelbarrow, but the locomotion of matter by means of a revolving disc. In the course of litigation the courts decide that the revolving disc is the only means of locomotion for a vehicle, whatever its form, since in all the inventions of vehicles since the invention of the wheelbarrow, the wheel is used. By reason of the claim and the tacit assumption and concession thereto, Mr. A has exclusive right to the use of a wheel for a vehicle. The result of this assumption and concession is that even though a Mr. B invented a vehicle with two wheels as a bicycle or chaise, a Mr. C a vehicle of three wheels as a tricycle, a Mr. D a four-wheeled vehicle as a coach, a Mr. E a steam locomotive, yet none of these inventions may be used if Mr. A chooses to exercise his assumed and conceded exclusive right to the use of the wheel. Mr. A has power not only to prevent the development of these various inventions, but also the power to say to the public, *you shall ride only in wheelbarrows.* This is done during the life of Mr. A's patent. Just before the expiration of the life of A's patent, a Mr. F receives a patent for a metallic band or rim for a wheel which shall be known as a tire. For a commercial success it had been found necessary to use a metallic tire during the whole period of A's patent, but the patent for the tire takes its life for many years after it has been in use. Moreover, Mr. F has his patent issued to Mr. A, who, on the

strength of this patent, is to say to the public for a period of seventeen years from its date, *you shall not enjoy carriages, railway trains, bicycles nor chaises; you shall ride only in wheelbarrows.*

It is clear that there should be no interpretation given to a patent nor any concession made thereto which could serve to nullify the property rights of other inventors. Such nullification is conclusive that a law or principle of nature in its application has been claimed as the matter of the invention, however skillfully the claims be worded to seemingly avoid the actual claiming of natural laws and principles.

A principle or law of nature, even though a discovery, is not patentable in itself, nor is its application to actual physical processes; only the particular physical process or processes applying the principle or law are patentable. In other words, actual inventions may be patentable, but no application of a principle to a purpose is to secure by patent the control of all possible conceived, or as yet unconceived, inventions which shall apply the principle to the same purpose.

For instance, Mr. G discovers that if he mixes a solution of sodium carbonate and dilute sulphuric acid the salt, sodium sulphate, results; he also concludes that the law governing this reaction is that of the action of an acid on a base to form a salt. Now, shall he be granted a patent for the formation of salts by the action of an acid on a base? Shall he, by reason of such a patent, control all subsequent discoveries of salts resulting from the reaction between acids and bases?

The Bell and Berliner patents are complete parallels of the above. In each case a particular instrument was discovered which transmitted speech; the law thereof was also disclosed by each inventor. Now, both the Bell and Berliner patents have tried to claim the application of a principle to all possible instrumentalities for transmitting speech. Should, however, the Bell and Berliner patents be confined to each respective particular invention, then the telephone monopoly would be an impossibility; for then the monopoly could not have been based on the exclusive right to apply a principle; *i. e.*, in the one case, the exclusive right to apply the undulating of a current of electricity in form similar to sound waves in air in order to transmit speech; in the other, the exclusive right to apply the maintenance of constant contact between electrodes in order to undulate a current of electricity in form similar to sound waves in air in the transmission of speech.

The United States Constitution reads (Section 8): "The Congress shall have the power (Clause 8) 'To promote the progress of science and useful arts, by securing, for limited times, to authors and inventors the exclusive right to their respective writings and discoveries.'".

If we ask the question, Why was this power delegated to Congress? we shall find the specific answer in the enacting clause, the so-called preamble: "in order to establish justice, promote the general welfare."

Now, the Constitution does not say that Congress shall be obliged to secure to an inventor or discoverer exclusive right therein; it says that Congress shall have this power which may be exercised or not as its judgment shall dictate, provided that such exercise shall achieve the objects not only of this clause, but of the enacting clause as well. The object of the eighth clause of Section 8 is not to protect inventors. Its object is to promote the progress of science and useful arts by a means, viz., by securing to inventors exclusive property rights. Congress has no power whatever to secure to an inventor an exclusive property right which shall serve to hinder the progress of science and useful arts. Nor has Congress any power to secure a property right to an inventor which shall establish injustice or which shall impede the general welfare.

Now, in view of the above, who dare say that the Bell exclusive right has been just to other inventors? Who will say that, by the exercise of the exclusive right of that patented application of a principle, the general welfare has been promoted? Who will say that the exclusive right of that patent as exercised has promoted the progress of science and the useful arts?

Again, who will say that the Berliner 1891 patent as interpreted, if exercised as an exclusive right, will establish justice to other inventors? Who will say that it will promote the general welfare? Who will say that it will promote the progress of science and the useful arts?

As did the Bell patent, so will the Berliner patent work injustice to other inventors; as did the Bell patent, so will the Berliner impede the general welfare; as did the Bell, so will the Berliner patent hinder the progress of science and useful arts.

Therefore, in view of the results to the people and to the progress of science and useful arts, neither the Bell nor the Berliner patent had nor have any legal status except as to the particular mechanism invented.

The assumed right to exclusive applications of the principle of constant contact between electrodes need not, aye, indeed, can not, be conceded, since such concession will insure the exercise of such right to establish injustice; to impede the general welfare; to hinder the progress of science and useful arts.

Therefore, the Berliner claims on which the Bell Company hopes to continue its monopoly of the telephone business are invalid and unwarrantably issued.

Therefore, the United States Patent Office has illegally conceded a right which has not only no warrant in the constitutional law, but which unwarrantably-conceded right is also, by reason of its antagonism to the objects of the Constitution, expressly denied therein by exclusion.

Therefore, any denial of the right to exercise a patent privilege because it utilizes constant contact between electrodes, the assumed exclusive right of the Berliner patent, is a subversion of the patent law of the United States Constitution.

The position herein taken is vantage ground for successful attack on the telephone monopoly; a vantage ground never before taken; a vantage ground clear of all obstructing arguments as to physical facts and theories or as to historical evidence as to whom is due the credit of having first invented the telephone.

In view of the position herein taken it would seem unnecessary to seek legislation to cure the ills of the telephone monopoly. The numerous bills before the last Congress seeking to regulate the telephone interests could have secured no more, nor so much, in fact, than would the proper interpretation of the constitutional patent clause.

Having irreverently attempted to overthrow the existing condition of things, what substitute can be offered that would remedy existing evils?

The patent problem necessitates the fulfillment of the following conditions:

First. The establishment of justice.
Second. The promotion of the general welfare.
Third. The promotion of the progress of science and useful arts.
Fourth. The protection of the inventor in his patent property rights under the above conditions.

To establish justice is to secure to each inventor his right in his invention, at the same time securing to the people their right in his privilege. The right of the people in a patented invention is the enhanced general welfare that might accrue from the same.

To promote the progress of science and useful arts would be to remove every barrier which would tend to check the development of an invention through withholding it from commercial competition.

To protect the inventor in his property rights, at the same time securing the foregoing interests, would be to throw his inventions open to commercial enterprise and competition, yet securing a just tribute to him from each enterprise.

For instance, to illustrate by the telephone: Why should not any one have the privilege of making, using and selling a Bell telephone, patent or no patent? Why should not Dolbear, Grey, Edison, Drawbaugh or any one else have the privilege of making, using and selling any of their inventions, Bell's patent or theirs being valid notwithstanding.

A little consideration will show that such a plan could secure the above-mentioned aims most completely; for no inventor would be denied his property right in his own invention to make, use and sell the same; for the people's general welfare would not be deteriorated because of withholding from commercial use and competition any invention of value to their welfare; for the progress of science and useful arts would not be impeded by denying an inventor the opportunity to develop his invention; for the inventor would not be denied the possibility of a just return for his labor.

Bearing in mind that the security of the inventor is a secondary consideration to that of the development of science and useful arts, there should, therefore, have been no restriction, no exclusiveness in the use of the Bell telephone, provided every instrument secured to Bell an adequate return. Let whomsoever chooses make, use and sell the Bell telephone, each manufacturer paying, however, a royalty to Mr. Bell or his assignees. Now would result competition, the only fictitious price being due to the amount of royalty paid. Bell's assignees would enjoy the privilege in competition of greater profit to the amount of royalty paid by others, should they choose to manufacture themselves. This competition would secure a benefit

to the people, since monopolistic power to demand excessive toll would be impossible.

Again, granting that Bell was entitled to the broad claim issued to him which, as interpreted and exercised in the past, excluded all other inventions from the field as infringements thereof, let the infringing inventions be put into commercial competition; let them be made, used and sold by whomsoever chooses to do so, securing, however, to the inventor of the particular instrument *his* just return, and to the infringed claim of Bell its just due. Let Dolbear, Grey, Blake, Hunnings, Drawbaugh, Berliner instruments be put into commercial use the same as if all the present patents had expired. Then competition would give to the public benefit the advantage of the best instruments and service at the price competition would establish. Then competition would give each and every inventor a chance to use his invention unhandicapped in the struggle for existence. Then would the progress of science and useful arts be promoted through development from use in competition. Yet if the Dolbear, Grey, Blake, Hunnings, Drawbaugh, Berliner inventions infringe the Bell patent, let each pay due tribute to that patent. So should Bell pay Blake or Drawbaugh due return should he choose to use their inventions.

In other words, under the patent system let there be the same business competition as would obtain without it, the only restraint being the tribute to the inventor. Such tribute would be undiscriminating, since all alike would be obliged to comply with the same condition.

The only question of any importance remaining is, How to secure the inventor? In the first place, the indiscriminate issue of patents with no value attached to them should cease. Every patent issued to an inventor should be a grant of as good title as a grant to public lands. Then to secure to the patentee a return on this guaranteed value the government should issue to all manufacturers under that patent a tax stamp, to be used on each instrument made, of course making it an offense for the manufacturer to sell without such stamp. Of this stamp tax a certain percentum should go to the government to secure it a return for the privilege granted and the labor of collecting, the remainder being paid over to the inventor. In case one invention involved in its use the property of another, the infringement and royalty to be paid by the one inventor to the other would be already determined by the tribute paid by those manufacturing under the infringed patent.

For instance, if Mr. A, manufacturing Bell telephones, pays a royalty of 10 cents per year or a dollar outright per instrument, then Mr. B making a Blake instrument must pay a tax sufficient to secure Blake and Bell; so that the tax on the Blake instrument would be 20 cents, or $2. Not that all inventions are to receive the same royalty but that the tax should be such as to be non-prohibitive of public use. Such a tax system would necessitate the progress of science and useful arts, for in order for the Blake instrument to pay the double tax it would be necessary for it to be a superior business competitor.

This plan, therefore, achieves the several desirable aims of the constitutional patent and enacting clauses.

## Magnetic Units.

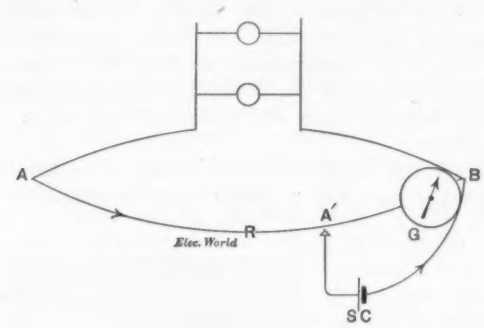
The London *Electrician* thinks that the ampere-turn is the crux of the difficulty in devising a system of magnetic units. Practical men, it says, have grown to regard this quantity as a very real and fundamental unit; while scientists must look upon it as a complex thing, only to be connected to their rational systems by a linkage of coefficients and equations. Yet it doubts if the practical man will ever surrender his ampere-turn; and the best that can be done is to adopt a system of units which will make those coefficients and equations least troublesome. Some suggestions toward a reconciliation, and the construction of a rational magnetic system, have been carefully compiled by Prof. Oliver Lodge, at the request of the electrical standards committee of the British Association, in which he proposes two alternative systems. The *Electrician*, in referring to these, says it would wish, with Mr. Baily, to see the unit of magnetomotive force made equal to one ampere-turn, even though at the cost of saddling $\mu$ with $\pi$. This would be of immense value to practical men; and it should seem of but trifling importance to theorists. In regard to the size of the units, the *Electrician* considers that the only practicable settlement will be to introduce a number of multiple and sub-multiple units for practical use.

## Exact Measurement of Voltage, Current and Resistance.

BY JOHN C. BLACK.

In the Digest of July 20, under the heading "Units, Measurements and Instruments," is an abstract of an article by Mr. Thiermann in the *Electrotechnische Zeitschrift* of June 27. This article treats of an apparatus for the exact measurement of voltage, current and resistance. The accompanying diagram is a simple modification on the same principle, and explains itself.

To enter into some detail, $A$ and $B$ are the points at which the difference of potential is to be measured, $R$ an adjustable resistance, $G$ a galvanometer, and $S\ C$ a standard cell of known voltage, the current to flow in the direction indicated by the arrows. To make the measurement, the adjusting arm of the cell $A'$ is made to "put in" or "cut out" resistance in $R$, and so varying the potential between the terminals $A'$ and $B$, and when such a resistance is cut out that the galvanometer shows no current—then the difference of potential between $A'$ and $B$ and that of the cell must be the same, and by finding the ratio of the "cut out" resistance to the resistance in $R$ and multiplying by the voltage of the cell gives the potential between $A$ and $B$. An example clearly shows this to be true.




If $R$ is 500 ohms and the "cut out" resistance is 5 ohms, and the cell has a pressure of 1.1 volts, then $500/5 \times 1.1$ equals 110 volts between $A$ and $B$, the drop being 1.1 volts per 5 ohms

This method is much simpler than Mr. Thiermann's, for the reason that $R$ can be comparatively small to measure even high voltages. The limit to which it can measure can be almost indefinitely increased by either adding cells or increasing $R$ or its power to measure small voltages by the reverse process. This could be called the "Single Loop Method" to distinguish from Mr. Thiermann's "Double Loop Method."

## Electric vs. Animal Power.

The *Journal of Gas Lighting*, in a recent issue, expresses its conviction that "there seems to be a deplorable waste of power in electrical tramway systems, which requires stopping before this means of working can claim to be economical." The particular example of electrical tramway traction which has given rise to this sweeping statement, says the London *Electrician*, is that which, after one year's working by the contractors, is now passing into the hands of the municipality of Brussels. And the "deplorable waste" which our contemporary alludes to is thought by it to arise from the fact that a car which "a pair of Flemish horses could easily run away with" requires much more than two horse-power of engine plant to be allotted to it. Our contemporary has fallen into the common error, at one time more common than it is now, of supposing that in an economical system of electrical traction the amount of horse-power of an engine plant ought to be comparable with the number of horses which would be required to keep the cars moving. There is, in reality, no sort of connection between the two things, as our gas friends would pretty soon discover if they tried to run the cars with gas engines. "What an enormous surplusage of electrical power, as compared with horseflesh, marks this installation!" cries our contemporary. Quite so. But it by no means follows that that surplusage is always in actual use, and it is quite erroneous to suppose there "must be something very crude about a system which needs 900 indicated horse-power to keep 22 tramcars moving." This power is not required to keep them *moving*; it is mostly a reserve to start them. Besides, while the "pair of Flemish horses" are running away with the car, there is, it must not be forgotten, a "surplusage" of several horses eating their heads off in the stables.

## The Association of Edison Illuminating Companies.

The next annual convention of the Association of Edison Illuminating Companies will be held at the Hotel Cadillac, Detroit, Mich., Aug. 13, 14 and 15, 1895. The first two days of the Convention (Aug. 13 and 14) will be devoted to papers with discussions, together with any business which may come before the meeting. On the last day (Aug. 15), the delegates will be entertained by The Edison Illuminating Company, of Detroit, and the General Electric Company.

On account of the large number of short papers to be presented, the proceedings of the Convention will be particularly interesting, and as many new companies have been admitted a large attendance is expected. Mr. C. P. Gilbert, secretary and manager of the Detroit Edison Company has arranged for the accommodation and entertainment of the delegates, and a very enjoyable time is anticipated. The approach of the annual convention of the Association recalls the history of that useful organization. This history, though simple in the extreme, and not marked by any violent manifestations either of rivalry, discontent or disruptions—those elements that seem characteristic of most organizations—is nevertheless highly interesting to the student of electrical progress. Between the lines that tell the story of the association's career may be read the history of incandescent lighting in America. It is one of the romances of the modern world, this narrative of the Edison "glow lamp" as it is sometimes termed. How it was engineered to the front rank as one of the essentials of civilization is told in the record of the doings of those who had most to do with its commercial development.

Away back in the early eighties the greatest worker of any age was toiling night and day to perfect his incandescent lamp. No amount of discouragement or repulses daunted his courage or weakened the faith of those about him—and he succeeded.

Once scientifically perfect, the next thing in order was the introducing of the lamp into public use. Then, as always, it was hard to interest capital at first. Slowly, however, investors realized that the new illuminant had come to stay, and little by little money left its hiding places and was lodged in local companies for manufacturing incandescent light and supplying same to the public. These stations were but struggling infants when, early in 1885, a call was issued that resulted in the organization of "The Association of Edison Illuminating Companies" at Harrisburg, Pa., April 15, 1885. The call read:

"The rapid progress made during this generation in the application of electricity to the production of light and power, exceeds by far the progress of any other industry for a like period. Associations of persons engaged in the same line of business have been found of great benefit in bringing together those familiar with the varied conditions under which they individually operate, and through the interchange of views and experiences, and by comparison and consultation, thus making the knowledge of one the knowledge of all, to the advantage of their common interests."

The objects of the association were declared to be "the collection and dissemination of information relative to the Edison system of electric illumination, and the mutual protection of the interests of those engaged in the business."

At that time what was later consolidated under one head, the different branches of the ever-increasing Edison business, was known as the Edison Machine Works, Edison Lamp Company, Bergman & Co., and the "parent" company, the Edison Electric Light Company.

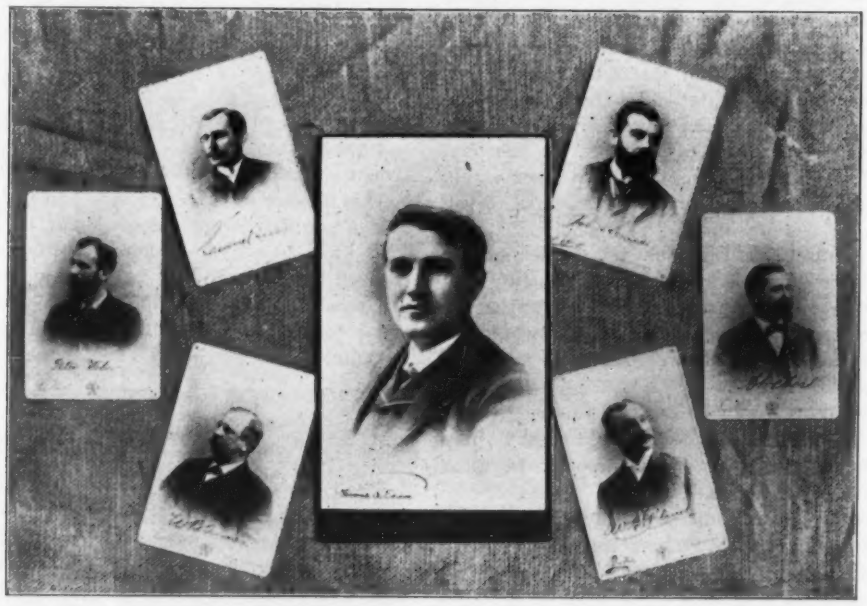
Only six illuminating companies were represented at the first meeting. A preliminary organization was effected, with J. S. Humbird as president; F. S. Marr, secretary; H. K. Wood, vice-president, and W. Auten, treasurer. One of the attendants of this meeting was the celebrated Sam Insull, in whose subsequent career was involved for a time the destiny of the entire industry. Insull was always a great friend of the association and never lost an opportunity to help it along.

At this pioneer meeting a cardinal truth was forcibly expressed, namely, that "the fault in the practical operation of stations lay in the lack of knowledge on the part of managers rather than inherent defects in the apparatus." How many a disgusted stockholder will turn pale at reading this, when viewed through the loss of thousands to educate men in the management of electrical enterprises?

It was decided at Harrisburg to call a meeting at Pittsburg for June 3 of the same year. In accordance with this the meeting was duly held on the date given. Nine companies were represented, and letters of regret were received from many.

On the completion of the permanent organization the following officers were elected: President, J. S. Humbird; vice-president, Wm. Schmenck; secretary, F. S. Marr; treasurer, H. K. Wood.

The third meeting was called to order at Atlantic City, June 9, 1886. The representatives from local companies were quite numerous. Missionaries from the home industries included such well-known characters as W. S. Howell, of the Lamp Works; Chas. Batchelor, J. W. Howell and J. H. Vail, then general superintendent of the Edison Company for Isolated Lighting.



Some of the Pioneers.

The president elected was J. I. Beggs, who for many years afterward was the ruling spirit of the association. He was repeatedly selected president against his own wishes, but always accepted for the good of the cause. J. H. Vail became secretary and W. S. Howell treasurer.

The fourth convention was held at Long Beach, N. Y., Aug. 11, 1886. This meeting was signalized by the appearance of the immortal E. H. Johnson, then president of the Edison Electric Illuminating Company, of Boston. In these practical, busy days we are not given to pondering much over the means by which we attain an end, and all too often lose sight of the interesting personalities of other days; but no one can read the history of incandescent lighting without granting to Mr. E. H. Johnson full credit for doing more to advance the business than any other ten men now living.

L. Stieringer, another of the picturesque and always entertaining characters of early days, is also down in the record as an attendant,

Mr. Stieringer was ever afterward one of the most devoted workers for the organization, and no meeting was reckoned complete without "The Pirate," as he was called, because of his austere visage.

Another man who rose rapidly from this time was W. J. Jenks, now chief patent expert for the General Electric Company. Mr. Jenks took a fatherly interest in the association, and to his well directed and untiring efforts is due the success which later on came to the society.

F. S. Hastings, still lovingly remembered by all the pioneers of that time, is down as having "arrived at the afternoon meeting."

Mr. Edison turned up unexpectedly, meeting for the first time

SAMUEL INSULL.

J. H. VAIL.

the men who had paid him the greatest compliment he could receive —investing money in his system.

A curious feature of this meeting was the request made by the illuminating companies on the Lamp Company for "lamps of 10, 13 and 16 cp." It was recognized as having especial significance, coming as it did from the users of lamps themselves. It was the first of a long series of similar practical suggestions made to the parent company that always bore fruit. Lightning protection was brought up and discussed. The fact was developed that Mr. Edison had indorsed the practice of using "barbed copper wire grounded in numerous places throughout the system." Fire insurance was also considered, and many valuable suggestions made for the handling of this feature of central station practice. Mr. Jenks, designer of the Edison municipal system, read from THE ELECTRICAL WORLD extracts from a paper published in that journal descriptive of the system.

The fact was brought prominently to notice that the Westinghouse Company, then a newcomer into the electrical field, were infringing the Edison patents, the infringement "extending also to the feeder patent, three-wire patent, and patents regulating pressure." The always aggressive E. H. Johnson clearly stated the position he would take, and that was to fight. The "fight" was one of the most disastrous and expensive on record, as all remember. A resolution was passed, offering the Edison Electric Light Company their (the association's) hearty co-operation and moral support in fighting infringers of the Edison patents, which resolution proved to be more far-reaching than was foreseen. Years afterward, when the Edison and the Thomson-Houston interests were consolidated, the spirit of this resolution lived, and caused many a restless night to the managers of the General Electric Company.

Among the notables present were F. J. Sprague, then of the Sprague Railway Motor Company, and W. S. Andrews, chief engineer of the Edison Electric Light Company. One of the practical subjects discussed was the adoption of "standard blank form for central station accounts." Another highly interesting feature was the presentation, by Mr. Sprague, of the claims of his stationary motor. The discussion led to the following resolution:

"*Resolved*, That in view of the increasing interest in electric motive power, that the Edison Electric Light Company be requested to prepare a full explanatory circular on the use and application of stationary motors."

Thus did the stationary motor business get its first real good impetus from an association devoted to illumination.

The next meeting (the fifth) was held at Powers's Hotel, Rochester, N. Y., Feb. 9 and 10, 1887. Some of those in attendance who afterward attained fame were W. J. Hammer, C. E. Chinnock and W. T. M. Motham.

A unique character at this meeting was Ischisuke Fujio Ka, royal commissioner to His Imperial Majesty, the Mikado of Japan. At this early date the far-seeing ruler of the Island Kingdom realized the importance of electrical development, having sent this commissioner to the United States to study the progress we had made. Through what stages may we not trace the results of this visit on the future of Japan, and especially on the outcome of the late war with China?

The meter system of measuring incandescent current was prominent in the discussions of this meeting, and it was pretty definitely decided that this method was the most satisfactory to go on.

The convention also gave considerable attention to the adoption of rules for wiring buildings, and outlined the first practical code for safe wiring. It also adopted as standard the Edison voltmeter.

H. McL. Harding, representative of the Sprague Motor Company, reported that his company had in operation over 50 motors, most of which were in Boston, where they were giving the best of satisfaction.

F. R. Upton, then one of the prominent Edison lamp men, and later the guiding genius of the Edison incandescent lamp works, was another newcomer at this meeting.

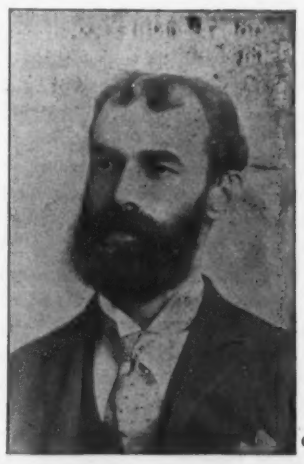
The conservative spirit that has always characterized the Edison association was much in evidence when the discussion arose as to the admission of persons whose interests were not strictly Edison. The consequence was an amendment to the by-laws barring any one "unless his firm or corporation shall have a money investment of not less than $25,000 in the Edison business, and that such representative must be an officer of his firm or corporation." Accordingly a number of persons who had up to this time taken an active part in the meetings resigned.

By the time the next meeting was held, Aug. 10 and 11, 1887, at Altoona, Pa., the membership had increased wonderfully. Forty-one companies had joined, and there were 61 members in attendance. Ninety local Edison companies were then operating in various parts of the Union. Among the staunch friends of the organization present was E. K. Weeks, of Kansas City. His dome of thought was always considered away above the average, and his words have since been listened to with profound respect whenever he spoke. H. Ward Leonard also appeared for the first time, coming as a delegate from the Edison Company of Rockford, Ill.

The notable papers of this meeting were "The Development and Future of the Edison Municipal System," by W. J. Jenks; "Commercial Value of the Transmission of Power," by W. J. Hammer—a paper remarkable for its scope and accuracy of prediction; "The Value of Storage Batteries Applied to Central Stations," by J. H. Vail, in which Mr. Vail laid down broad principles relating to the installation and care of accumulators.

Chicago was selected as the next place of meeting, and, accord-

W. J. JENKS.



L. STIERINGER.

ingly, on Feb. 8 and 9, 1888, the association met in the Grand Pacific Hotel, Chicago. Fifty-eight responded to the roll-call, including Mr. Edison and C. L. Edgar, who represented then, as he does now, the Edison Illuminating Company, of Boston. Mr. Edgar has, by the way, made this one of the most successful and profitable stations in existence.

Some surprising and gratifying figures were given as to the development of the various Edison stations. Philadelphia reported

a total of 140,000 lamps, and a cash investment of $1,650,000, embracing 26 miles of underground conductors. Chicago made a good showing with 9,000 lights wired, and a station equipment for 35,000. Kansas City told of an increase of capital stock from $100,000 to $300,000, having 10,000 lights wired and connected. It was agreed upon at this meeting that 1 cent per 16-cp lamp-hour should be the standard rate for incandescent light, a rate that has since become universal.

Mr. J. H. Vail presented some interesting statistics on "The General Progress of the Edison Business During the Year," showing that the rate of increase in capital invested and business done had been tremendous.

In the obituary record for the year appeared the name of T. W.

E. R. Weeks.

H. Ward Leonard.

Embree, who was killed in the boiler explosion at West Chester, Pa. This is one of the very few cases where a life has been lost in operating the Edison system, and is the only case on record of death under similar circumstances in the electrical business. The total capitalization of Edison illuminating companies at this time was reported to be about $10,000,000.

Mr. Jenks's paper on "Incandescent Lighing by High Potential" brought out all the cardinal objections to the alternating system that for years afterward were considered as unchangeable by believers in the low-tension system. Jenks's papers, because of their clearness and cleverness of style, have always been recognized as models of Edison literature.

The famous "Standardizing Bureau," established in the interest of regulating station methods, passing on the product of the factories in the interest of licensees, and making reliable rules for station management, was practically settled upon at this convention. "Telegraph Circuits from Dynamos," "Fire Insurance," and other subjects were fully discussed and acted upon.

The next meeting was held at Nantasket Beach, Aug. 8 and 9, 1888. This meeting was notable for the length of its five sessions. H. Ward Leonard's paper, "Distribution of Copper for Highest Economy," in the two and three-wire systems, was the feature of the meeting, while W. J. Jenks's treatment of the lightning question, illustrated by 50 stereoptican slides, stands unrivalled as the fullest treatise on that subject ever attempted.

As is well known, newspaper men have never been admitted to the meetings of the association, but for some reason, at the evening session, the quill knights present were invited to attend. Among others were T. C. Martin and W. I. Barker, representing The Electrical World, and R. F. Ross, of *Modern Light and Heat*.

Niagara Falls, N. Y., was selected as the place for holding the tenth semi-annual meeting to comply with the wishes expressed at the last session that meetings be held where the delegates could combine pleasure with business. In a way this meeting was memorable as it marked the first stage of consolidation that later on struck the name of Edison from the company entirely. That the central station managers felt apprehensive as to this was evident from the discussion which arose to draw from the parent company a declaration as to just how it stood regarding their interests. Vice-President Herrick replied that "the general idea was to consult and harmonize all the interests connected with the Edison system, and, by cheapening the cost of production, benefit the general public, as well as the illuminating companies."

A. E. Kennelly's paper on "The Heating of Conductors by Electric Currents" was one of the ablest papers ever read before any electrical body, and has served as the base of tables of heating limits the world over.

Other papers were "The Maximum Efficiency of Incandescent Lamps for Central Station Work," by Leigh Carroll, of Birmingham, Ala.; "Fuel Gas," by Jno. R. Markle, and "High Potentials as an Adjunct," by resolution of C. P. Gilbert, of Detroit. The improved chemical meter was also thoroughly discussed, as well as the motor question. One of the side lights of the event was afforded by Mr. Kennelly's interesting experiment to determine the energy of the Falls. Including the evening's session, at which Mr. W. J. Jenks, the secretary of the organization, gave a stereoptican entertainment, six sessions were held, and adjournment taken to meet at St. Paul one year later. The Eastern delegates journeyed all the way to St. Paul in a special car, and their advent gave special importance to the 11th meeting (second annual). The new electrolytic meter offered by the Edison laboratory was the feature of the opening session, and the efforts made to perfect same by Mr. Edison were warmly praised.

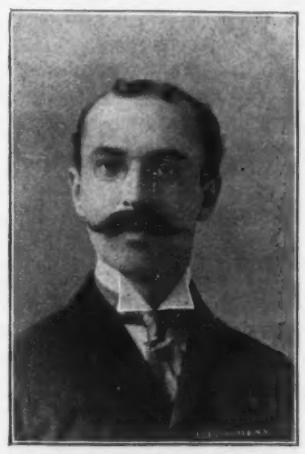
The insurance question was widely and fully discussed, and steps taken to secure a national code of rules to govern electrical installations. As may be gathered from this brief historical review, it will be noticed that the Edison Association has been responsible in a large measure for the formulating of definite rules of insurance—in fact having fathered and perfected the system now in use, though now known under a name that gives no clue to its real origin.

The great industrial exposition was in full blast when the meeting was held, so that the delegates had an excellent opportunity to witness the famous light display afforded by the "Tower of Light" that had been installed by the Edison Lamp Works after designs by L. Stieringer.

The staff of the home office included Samuel Insull, H. Ward Leonard, John Muir, F. R. Upton, F. E. Jackson, W. S. Howell and M. J. Sullivan. Mr. Muir, who bears a resemblance to Edison, was introduced to some of the local newspaper boys as the Wizard, and, of course, played his part to perfection. The timely disavowal by Mr. Insull, however, saved some of the enterprising Minneapolis journals from a great hoax. The journey home was quite as enjoyable as the trip out, the delegates stopping at Chicago long enough to inspect the Edison interests there.

The meeting of 1891 may be considered the greatest success in the association's history. It was held in New York City, Aug. 11–12, and the efforts of the parent company, together with those of the New York Illuminating Company, operated to make the delegates feel they were on one grand outing. But those were in the days of Insull's regency, and he knew how to make a success of anything he undertook. Nearly two hundred delegates and officers of the Edison General Electric Company took part in this memorable meet. Among the papers that attracted particular attention at the time were: "Grounding the Neutral Wire in Three-Wire Systems," by A. E. Kennelly; "How to Get Paying Loadson Stations," by Prof. William D. Marks, and "Some Practical Ideas on Distribution," by Leigh Carroll.

The Edison Company of New York provided carriages for the trip visiting the various stations of that company, and in the evening tendered a handsome banquet at the Hotel Brighton, Coney Island.



W. S. Barstow.

W. J. Hammer.

The next day Mr. Insull, on behalf of the General Company, had a special train provided for a trip to Schenectady. Breakfast was served in the dining car attached to the train, and on reaching the works the train was side-tracked into the yards of the company. Lunch was served on board the train, and after a most delightful visit that clearly demonstrated to the pilgrims the magnitude of the

Edison interests, they returned to New York. That night most of the delegates attended the Gilmore concert at Madison Square Garden. Later in the evening many informal affairs were held in various sections of the town, no written record of which appears, but fragrant memories supply the data if any one wants to know just what happened.

Before another year rolled around all the brilliant prospects here apparent of the Edison interests winning against competitors had vanished in the mirage of consolidation, so that in a large measure the glory of the association ended with the 1891 meeting.

Canadian hospitality will always find its stern champions in the electrical ranks if in no other by reason of the many attentions paid to the visiting delegations at various times. The meeting of Aug. 9 and 10, 1892, was no exception, for the local Edison Company of Toronto did everything possible to make the event enjoyable. The gathering of the old timers was signalized by the first appearance of Mr. C. G. Coffin, whose kindly manner and unostentatious ways won every heart. His declaration as to the policy of the General Electric Company toward licensees was a master stroke, and because of its importance is still vividly remembered by all present.

Among the papers read were "Crosses with High-Tension Circuits," by C. P. Gilbert; "Interior Wiring of Buildings," by Prof. W. D. Marks; "Insurance Affairs," by Capt. W. Brophy; "Triple-Expansion Engines," by J. H. Vail, a most remarkable treatise on this subject.

S. Dana Greene, for many years one of the ruling spirits on the inside circle in Edison affairs, came out at this meeting as the practical head of affairs for the General Electric Company. Mr. Coffin was, of course, the executive officer, but as at later events Mr. Greene had most to do—looking after the great company's affairs with the delegates.

The ninth annual meeting held in the never-to-be-forgotten "White City," Chicago, Aug. 8 and 9, while one of the most enjoyable of all the conventions, was also one of special importance in a commercial and scientific way. In all three sessions were held, and 20 different questions discussed. For the first time in years a change was made in the executive staff. C. L. Edgar, of Boston, was elected president in place of Mr. Beggs, and W. S. Barstow, the clever and energetic general superintendent of the Brooklyn Edison Company, who had been one of the diligent attendants at all recent meetings, took the post of secretary in place of Mr. Jenks.

"The State Control of Electric Lighting Interests" was warmly discussed by the president and L. E. Barker, chairman of the Board of Gas and Electric Light Commissioners of Massachusetts. The "Relations between the Association and the General Electric Company" was ably presented by Assistant Manager Greene. Mr. Stierinser presented a paper descriptive of the World's Fair electrical engineering, and acted as pilot for the visitors on their tour of electrical inspection. Mr. O. B. Herrick presented a highly valuable paper on "Switchboard Construction."

Of course, the manifold attractions at the Fair cut the sessions short, as many of the delegates wanted to improve the time seeing the sights. They did the "Midway" in a body and all seemed to get quite a "run for their money," as someone graphically expressed it. Particular praise was bestowed on the General Electric exhibit, then under the charge of Lieut. E. J. Spencer, who made a great success of his mission.

As a compliment to the president the next meeting was held in Boston, Aug. 14, 15 and 16, and was well attended. A. E. Kennelly, who had for years represented Mr. Edison's laboratory at all the meetings, reported on behalf of the committee on lightning protection and crosses with "high-tension wires," and started a lively discussion. Prof. W. D. Marks read one of his highly interesting productions entitled "A Board of Control for Central Stations." Mr. Hale's paper on "Boiler Testing," and Mr. Van Vleak's treatise on the "New York Illuminating Company's Switchboard," were both extremely interesting. Mr. Barstow's presentation of "Low-Tension Arc Lighting Systems" was another feature of the first session.

The discussion of greatest interest, however, was provoked by Engineer Emmet on "The Relative Advantages of Alternating and Direct Current Apparatus for Central Station Work," which brought out all the points of the new "Monocyclic System" of the General Electric Company. The entertainments afforded by the Boston local company and the General Electric Company were unique and highly appreciated, and the meeting was voted a big success.

The meeting to be held at Detroit promises to be unusually interesting and pleasant, an excellent programme having been prepared for both the mental and physical entertainment of those who attend.

## Electrodynamic Machinery.—XLIV.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

314. We may now allude to the theoretical conditions, which must be complied with in order to obtain the maximum amount of torque in a motor for a given mass of material. It must be carefully remembered, however, that these theoretical conditions require both modification and amplification, when applied to acute practice, so that the practical problem is the theoretical problem added to the problem of mechanical considerations.

315. The torque of a motor armature being $\frac{i \Phi \omega}{20 \pi}$ cm-dynes, we require to make this expression a maximum for the given mass of copper wire in the armature and in the field magnets, neglecting at present all considerations of structural strength.

The torque-per-ampere will be $\frac{\Phi \omega}{20 \pi}$ cm-dynes.

In order to have this a maximum both $\Phi$ and $\omega$ should be as great as possible.

316. It is evident that if we simply desired a motor of powerful torque-per-ampere, regardless of its weight, we should employ as much useful iron as possible, so as to obtain as great a useful magnetic flux $\Phi$, through the armature, as possible, and we should employ as many turns of wire upon the surface of the armature as could be obtained without making the armature reaction excessive, or without introducing too high a resistance and too much expenditure of energy in the armature winding. Such a motor would essentially be a heavy motor, so that the requirements of a motor with powerful torque-per-ampere would simply be met by a motor of great useful weight, and this, indeed, would be obvious without any arithmetical reasoning.

317. When, however, the torque-per-ampere per pound of weight has to be a maximum, the best means of attacking the problem is to consider a given total weight of copper and iron in the armature, and examine by what means this total weight can be most effectually employed for producing dynamo power; *i. e.*, volts-per-revolution-per-second, or torque-per-ampere.

318. It will, in the first place, be obvious that a long magnetic circuit will not be consistent with these requirements, since, as we shorten the magnetic circuit, retaining the same mass of material, we make it wider, or of greater section, and so increase the total flux $\Phi$. In the second place, the material of which the magnetic circuit is formed should have as small a reluctivity and as powerful a flux density as possible, since this will increase the total flux without adding to the weight. For this reason soft cast steel is much to be preferred to cast iron.

319. Again, it will be evident that as we increase the number of turns on the armature, having determined upon a certain total mass of armature copper, or winding space, we increase according to the formula, the torque-per-ampere. But, in occupying the given winding space with many turns instead of with few turns, we increase, for a given speed, the voltage of the armature. Thus, if a motor armature be intended to rotate at a speed of 10 revolutions per second, its E. M. F., other things being equal, will be 10 times as great, when we use 10 times as many wires upon its surface, and its torque-per-ampere will be also increased 10 times. A high E. M. F. motor is, therefore, necessarily a motor of high torque-per-ampere. A 500-volt armature would, therefore, in accordance with preceding principles, necessarily be a motor of greater torque-per-ampere than the same armature wound for 100 volts, although the torque at full load might be the same in each case, since the low-pressure armature might make up increase of current what it lacked in torque-per-ampere.

320. Having selected a field frame with as short a magnetic circuit as is consistent with not excessive magnetic leakage, and with room for magnetizing coils, and having placed a large number of turns upon the armature surface, there remain several important detail considerations which should be taken into account to enable a high torque-per-ampere to be obtained.

321. In the first place, the reluctance in a magnetic circuit should be as small as possible in order to diminish the M. M. F. and the mass of magnetizing copper. With smooth-core armatures this would represent a small *entrefer* and a small winding space, whereas, to obtain many turns we require a large entrefer and large winding space, so that with a smooth-cored armature, a compromise is necessary at some point of maximum effect, depending upon the great variety of detail constructions. With toothed-cored armatures,

however, a large number of turns may be disposed upon the armature surface, yet the reluctance in the entrefer may be comparatively small. This consideration affords an additional argument in favor of tooth-cored armatures for high torque.

322. In the second place the number of poles in a field frame should be as great as possible. If we double the number of poles in a field frame, retaining the same armature, and make suitable changes in the connection of the armature turns, we double the E. M. F. of the armature (Sec. 128). Thus, if we have an armature with a given number of turns on its surface and a given speed of rotation, in a bipolar field, and the E. M. F. obtained from the armature is 100 volts, then, if we change the field to a quadripolar frame, and suitably change the connection of the armature turns, the E. M. F. of the armature will be 200 volts. If, instead of changing the armature connections, we simply change the number of brushes from two to four, and suitably connect these brushes, we obtain only 100 volts as before, but as there are now four complete electrical circuits through the armature we have doubled the load which the armature can sustain without overheating and, therefore, practically doubled the output of the armature, and, consequently, when we double the number of poles covering the armature, assuming the

Fig. 206.—Quadripolar Car Motor with Two Field Coils.

useful flux through each pole to be the same as before, we either double the torque-per-ampere directly, if the armature be series-connected, or we retain a multiple-connected armature and utilize the advantage gained by employing a greater number of turns of the armature.

323. There will, of course, be a limit to the number of poles which can be employed with any armature without increasing its diameter, since there will only be sufficient room for a certain number of poles carrying a given maximum flux, and also, since the difficulty of magnetizing a greater number of poles will be insuperable, either for want of space, or owing to increased magnetic leakage. The principle, however, is important.

324. The number of turns which can be utilized upon the surface of an armature is itself limited, first, by the resistance of the armature and consequent excessive heating under load, by excessive armature reaction and consequent sparking, and, in rarer cases, by the E. M. F. of the circuit, and, consequently, the unduly slow speed at which a powerful armature will run on such circuit.

325. The best embodiment of the foregoing principles in existing practice is found in a modern street car motor. Here a powerful torque-per-ampere, with minimum weight, is desired in order to start a loaded car from rest up a steep gradient.

Two forms of such motors are shown in Figs. 206 and 207.

326. Fig. 206 shows a cast-steel quadripolar field frame with two magnetizing coils *M*, *M*. These produce not only poles at the opposite sides of the armature, in the cores over which they are wound, but also poles at the cylindrical projections *P*, *P*, which lie above and below the armature, so that there are four complete magnetic circuits through the field frame and armature, two circuits through each magnetizing coil. The brushes *B*, *B*, are set 90 degrees apart on the commutator *C*. The armature *A* is tooth-cored.

327. In Fig. 207 the same results are obtained with various detailed devices of mechanical considerations. There are four poles around the armature, two of which, *P*, *P*, are seen in the raised cover, and two others are similarly contained in the lower half of the frame. Each of these poles is, in this case, surrounded by a magnetizing coil, *M*. *B*, *B*, are the brushes, set 90° apart from the commutator. The armature, *A*, is tooth-cored.

In both of these cases the magnetic circuits are as short as is practically possible, and the useful magnetic flux is as great as possible.

328. The requirements of a motor depend upon the nature and use of the apparatus which the motor is designed to drive. These requirements, in relation to driving machinery, may all be embraced under three heads, viz.:

(1) Control of starting and stopping.
(2) Control of speed, both as to constancy and as to variability.
(3) Control of torque, both as to constancy and as to variability.

The above requirements are by no means met to an equal degree by the electric motor.

For example, the requirement of constant speed is much more readily met than the requirement of variable speed.

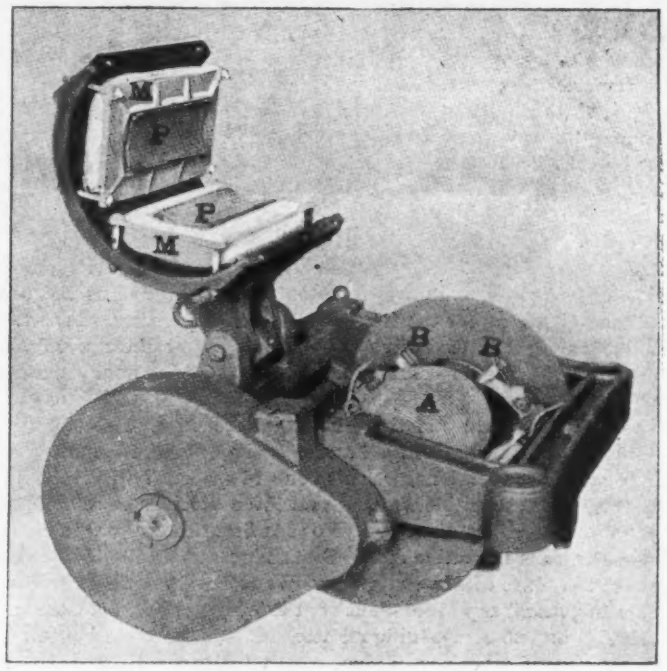



Fig. 207.—Quadripolar Car Motor with Four Field Coils.

329. The conditions under which motors have to operate may be divided into four classes, namely,

(1) Constant torque and constant speed.
(2) Variable torque and constant speed.
(3) Constant torque and variable speed.
(4) Variable torque and variable speed.

330. The first two conditions are readily obtained, the third and fourth are only obtained with difficulty. For example, a rotary pump belongs to the first class. Here the load is constant and the speed is presumably constant.

The second class comprises the greater number of machine tools, where the speed is constant but the activity is variable.

The third class embraces most elevators and hoisting machines.

The fourth class is well represented by street car motors.

(To be continued.)

Laboratory of Houston and Kennelly

## Electric Railways in Paris.

At present there are several storage battery lines running from Paris to suburban districts, and of these one is to be prolonged from the junction of the Boulevard de la Station and Avenue Du Nord to Pierrefitte. The department of state will give an annual subvention of 2,000 francs to assist the project. A concession has been asked from the Municipal Council of Paris for an underground conduit line from Place du Temple to St. Lazare Station along Rues Reaumur and Quatre Septembre. It is probable that this concession will be accorded.

## Comparisons of Different Lights.

Prof. Wedding, of Germany, ranks the different methods of lighting in the following order, considering only the cost: incandescent gas light, incandescent alcohol light, petroleum, Argand burner, electric incandescent light and acetylene. He adds that the arc light is ahead of all the others, that the cost is the same as that of the gas incandescent light, and that it is decidedly the best light for out-of-door purposes.

# DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

*Note.*—Typewritten copies of any of the articles referred to in the Digest, will be furnished at the rate of 5 cents per 100 woods for English matter, and 8 cents per 100 words for matter in foreign languages; translations at the rate of 40 cents per 100 words. Copies of any of the journals may be ordered; address Branch Office, ELECTRICAL WORLD, No. 927 Chestnut Street, Philadelphia, Pa.

## DYNAMOS, MOTORS AND TRANSFORMERS.

*Armature Cross Turns in Continuous-Current Dynamos and Their Effects.*—Mr. Adams's article (see Digest last week) is concluded in the Lond. "Elec. Rev.," July 19. He discusses analytically the effect of the armature ampere windings on the assumption made in the last article and deduces formulas from the results; with the aid of this he develops a sort of polar diagram constructed with the centre of the shaft as the origin, the radial distances from it representing respectively the induction in the air gap due to the direct ampere-turns and the induction due to the armature cross turns, thus forming two sets of loops which give a good idea of the conditions which exist; he shows how these curves may be determined graphically. In conclusion he adds that if the armature ampere-turns are large compared with those of the field, a curve may be obtained which has a negative loop and sparkless commutation will then be almost impossible; in order that the collection may be sparkless the ampere-turns of the field required to overcome the reluctance of the air gap, must be greater than the ampere-turns of the armature.

## LIGHTS AND LIGHTING.

*Train Lighting.*—The "Zeit. f. Elek.," July 15, gives the following figures regarding the installation on the Dortmund railway, the results of which are said to be satisfactory, both technically and financially. Tudor accumulators are used; the total cost of the installation, including the building and charging station, was $9,000; 27 cars are equipped with a total of 85 incandescent lamps; the cost of operation per 10-cp lamp-hour was 2.7 pfg. (0.68 cts.), or at 4 per cent. interest and 3 per cent. amortization it was 6.3 pfg. (1.6 cts.); for a larger installation it would be less, for instance, on the Jura-Simplon railway it is 4.1 pfg., and on the Danish railways 6.15.

## POWER AND HEAT.

*Gas and Electric Heating.*—In the Lond. "Elec. Rev.," July 19, Mr. Dowsing replies to a recent paper read in France in the interests of gas. The arguments, although not new, are well brought forth. Among other things he states that gas should be compared with electricity for heating purposes in the same way as coal should be compared with gas; the same amount of heat produced by coal would cost 1-24th that produced by gas; the reason why gas is better than coal for heating is certainly not because the heat is produced at a cheaper rate. Far less heat is required for cooking purposes than is generally supposed; in a trial with a gas oven it was found that out of a total of over 13,000 heat units required in roasting a joint of 8.5 lbs., only 2,203 units were actually used in the food itself, or about 16 per cent.; when it is remembered that the oven is one of the most economical systems of cooking by gas and more efficient than cooking by coal, it ought not to be a difficult thing for electricity to compete in spite of its higher present cost; he states that it may surprise many to know that the energy used in a 16-cp lamp for one hour would nearly suffice to cook a pound of meat, the heat being used, say, in a quarter of an hour, but the energy being the same. He believes it will soon be a rarity to find a house where electricity is used at all in which at least some form of electric heating apparatus is not to be found; there are signs that before long electricity will be cheap enough for use in many ways at present out of the question, and as an illustration he states that several applications have been received from bakers for heating their ovens electrically, which, however, at present charges would be prohibited; he points out this great field for supply companies as the current will be required from midnight until early morning, and there is probably no other outlet of so promising a nature; selling current when there is not even a day load available seems to be a move in the right direction.

## TRACTION.

*Moving Sidewalk in Paris.*—"L'Energie Elec.," July 16, states that a proposition of Mr. Gallotti is under consideration for a sort of electric railway from the base to the top of Montmartre (a hill in the city of Paris) which is to be quite similar to the moving sidewalk which was exhibited at the World's Fair. The speed of one of the platforms is to be 3 km per hour and that of the other, which contains the seats, is to be 6 km per hour; it is capable of seating 6,000 passengers at one time on 340 platforms, each of which has two double-reduction motors of 15 hp; the maximum power required is said to be 130 hp.

*Budapest.*—The "Elek. Zeit.," July 18, states that a contract has been closed with the firm of Siemens & Halske to change all the present horse-car lines into electric lines; the conduit system which has been in use for a number of years will be used throughout the denser portion of the city while the overhead trolley construction will be used in the outskirts; the cars will be so arranged that they can be run over both lines with very little delay in making the necessary changes.

*Accumulator Traction.*—According to the "Elek. Zeit.," July 18, the accumulator line from Hagen to Eckesey, on which the accumulator system has been running experimentally for some time, was officially accepted and opened July 10. (The Waddell-Entz copper-zinc accumulators are used on this line; see Digest, Feb. 9; also Feb. 23, March 2, 9, May 4, 18.)

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*Jungfrau Railway.*—The "Zeit. f. Elek," July 15, states that the construction of this mountain railway has turned out to be much more difficult than was supposed at the start. Questions arose whether there existed any tunnels at present having a 25 per cent. grade, and whether the electrical cable system would not be preferable, whether the warm air in the tunnel would not form ice due to the low temperature of the rocks, which ice would interfere with the electric contact. In reply to these queries it was stated that the deposition of ice in the tunnels would be small, and good ventilation would be provided for by the construction of towers; tunnels with such grades exist on several roads in Switzerland. It was suggested that it would be very difficult to protect the observatory from lightning; the dwelling for the observer will be tunneled in the rock; the lightning rods will be connected with copper plates placed in the snow. That portion of the road which is necessary for transfering materials during the construction, will if possible be completed this year, and will be operated with steam until the power stations are completed; the elevator running to the top will carry from 40 to 50 passengers; the construction of the first part of the road may begin in August and be completed in three months; the construction of the tunnels cannot be begun until the central power stations have been constructed.

*Railways in Tokyo, Japan.*—According to the "Elec. Friend" (Japan) for June several propositions are being discussed to operate electric railways in that city; there are now 85 horse cars in use; to replace these by a single trolley system it is estimated that a capital of $7,000,000 will be required; to use the double-trolley system on over 85 miles of the road, is estimated to require a capital of $2,000,000. From a lecture by Prof. Fujioka, on electric railways, published in the same number, it appears that the subject of the interference of railway and telephone circuits is receiving attention, as also the effect on iron, gas and water pipes, when the single trolley system is used (it is likely that the above estimate for the double-trolley system is for more miles of road than that for the single trolley).

## INSTALLATIONS, SYSTEMS AND APPLIANCES.

*Charging Accumulators with Alternating Currents.*—Mr. Pollak's recent paper, which was abstracted in the Digest, July 20, is published in full with illustrations in the "Zeit. f. Electrochem.," July 5. The same journal contains an illustrated description of the Pollak accumulator factory.

## ELECTRO-PHYSICS AND MAGNETISM.

*Phase Shifting of Alternating Currents by Electrolysis.*—Mr. Oberbeck, in discussing this subject (see Digest, June 29 and July 20), states that he agrees in every respect with the statements of Mr. v. Dobrowolsky (see Digest, July 20). He states that he made and published experiments in this direction in 1893 and 1894, and adds that the phase shifting becomes specially great by using aluminum or nickel electrodes; if this method is used for producing phase difference in practice, it will be best to use nickel electrodes, as there are objections to the use of aluminum.

*Magnetic Pull.*—An article by Mr. Jones from the "Wied Ann.," Vol. 54, p. 641, is abstracted briefly in the "Elek. Zeit.," July 4. The experiments were made with elipsoids of revolution which were cut in two; a table is given showing the difference between the theoretical and the calculated results, which average less than 1 per cent., but at high inductions are between 2 and 3 per cent.

*Magnetization of Iron by Very Small Forces.*—An article by Mr. Schmidt is abstracted in the "Elek. Zeit." from the "Wied. Ann.," Vol. 54, p. 655.

## ELECTRO-CHEMISTRY AND BATTERIES.

*Valency of Mercury and Copper in Certain Electrolytes.*—A full abstract of the recent paper by Dr. Bolton which was mentioned in the Digest,

June 29, is published in the Lond. "Elec.," July 19. He gives evidence in favor of the belief that a dilute solution of mercuric iodide in potassium iodide contains monovalent mercury ions, that is, it behaves like mercurous iodide. Editorially it is suggested that it would be desirable to obtain collateral evidence involving physical and chemical considerations wholly distinct from those concerned in the present experiment before finally accepting the view that an actual change of valency may occur by mere dilution; it is suggested that the same research with copper instead of mercury may possibly meet this requirement.

*Determination of Mineral Poisons.*—"Elek. Tech.," June 30, states that Dr. Kohn, of Liverpool, found that with the aid of electrolysis it was possible to determine extremely small amounts of metallic poisons, which is believed to be of great importance in proving cases of poisoning in the courts. If the poison contains antimony, copper, mercury or cadmium it is possible by means of electrolysis to detect a quantity as small as one part in 150,000.

*Electrolysis of Sugar Liquors.*—The paper of Messrs. Gin and Leleux which was mentioned in the Digest, recently, is published in full in the "Bul. Soc. Int. des Elec."; it is quite long and contains tables of data and illustrations.

*Seat of the E. M. F.*—Prof. Ostwald's paper, which was briefly abstracted in the Digest, July 20, is published in full in "Zeit. f. Electrochem.," July 5.

*Cementation.*—In noticing a recent paper by Mr. Marschik the "Zeit f. Elek.," July 15, gives the following figures: the usual process requires 11 to 13 days, the iron taking up 1.2 per cent. of carbon; by passing an electric current from the carbon to the iron while the metal is hot, the process requires only about three hours; the current is 55 amperes at seven volts and the temperature 900 to 100 degrees C.; the depth of cementation is 10 mm and the percentage of carbon 1.2.

*Austria Accumulator.*—The "Elek. Anz.," June 30, criticises very unfavorably the recent report, which was abstracted in the Digest last week; (the criticisms and deductions are not all reasonable); among other things it states that the Reichsanstalt ought in future to give not only the bare results of the tests but should also draw conclusions from them in order that the data may be properly understood. The criticisms together with the replies of the makers of the accumulator, are published in full in the "Zeit. f. Elek.," July 15.

*Electro-Chemical Laboratories.*—An article of Dr. Krueger on the arrangement of such laboratories is begun in the "Electrochem. Zeit." for July.

*Electro-Chemical Society.*—A full report of the second annual meeting of the German Electro-Chemical Society held June 6 to 8, is begun in "Zeit. f. Electrochem.," July 5; brief abstracts of the papers read have already been given in the Digest.

## UNITS, MEASUREMENTS AND INSTRUMENTS.

*New Method for Measuring Capacities.*—An Academy note by Mr. Bordier is reprinted in "L'Elec.," July 20, and "L'Eclairage Elec.," July 13. It is based on an experiment of Prof. d'Arsonval; if condensers of increasing capacities are successively connected in parallel to the same induction coil, and if by the aid of a rheostat or by moving one coil inside of the other, one reaches the conditions under which the least sensation is felt by the current on the skin, it will be found that the conditions vary for every capacity. For instance with a microfarad divided into tenths it is easy to find the conditions which correspond to the first sensation produced for each tenth of a microfarad which is added; in making the capacities the abscissas and the different positions of the rheostat or the coil, the ordinates, a curve will be obtained which represents the variations of the sensitiveness of the skin with the different capacities; having determined this curve one has only to find the conditions under which the sensation produced by the current begins, the coils being connected to the condenser whose capacity is to be determined; by referring to the curve one can then read off directly the capacity whose value is to be determined; the method is said to be susceptible of quite close approximation. The value for two condensers was thus found to be 0.915 and 9.91 microfarads, while the ballistic method gave 0.912 and 0.915 respectively. The sensation of the current does not always diminish as the capacity of the coil increases; if it is made of thick wire one will find that the sensation becomes stronger and stronger as the capacities increase. By this method the capacity of the human body may be determined quite closely; the subject is insulated and placed in series in one of the circuits connecting the coil with the standard condenser, a key being inserted to switch in or cut out the body; one such determination gave a value of 0.002 and a second 0.003; this value is about 58 times as much as that of a homogeneous condenser the surface of which is equal to that of the human body, and he suggests that this relatively high capacity of the human body may be due to the phenomena of condensation which takes place in the organs.

*Aperiodic Electrometer.*—"L'Eclairage Elec.," July 13, abstracts a description of the Hallwachs electrometer from the "Wied. Ann.," Vol. 55, p. 170, giving also a good illustration. The object was to construct a quadrant electrometer of constant sensitiveness which has a definite zero reading and is nearly aperiodic; the damping is accomplished by using air resistance in preference to magnets; it can be regulated and can be made as nearly aperiodic as is required; it enables one to measure voltages to a ten thousandth and is easily handled; the torsion is obtained by suspending the needle on a platinum wire 1-40 mm in diameter. When the needle is charged to 140 volts a deflection of 140 is obtained for one volt when the scale is placed at a distance of 2,000 scale divisions; with a longer suspension wire and a larger needle this can be increased four times.

*The Induction Coil as a Measuring Instrument.*—In "L'Elec.," July 20, Mr. Nodon describes a method by which an ordinary small induction coil can be used as an amperemeter, voltmeter and wattmeter or as a galvanometer of high or low resistance. It consists simply of placing a horizontal, magnetic needle attached to a pointer, over the middle of an ordinary induction coil whose circuit-breaker has been screwed down so that it cannot vibrate; the needle is pivoted, its deflections are read off directly and there is a directing magnet above it; the deflection will depend upon the current in the coil and on the distance between the needle and the coil; for large currents of low voltage the primary coil alone is used; for small currents of high voltage the secondary is used, while both are used together when the apparatus is intended to measure the watts; he states that it is quite sensitive.

*Disturbances in Scientific Laboratories Due to Electric Railways.*—The "Elek. Zeit.," July 4 and 11, reprints in full a very long discussion of this question at recent meetings of the Electrical Society of Berlin; among the speakers there are a number of prominent electricians and scientists and the subject was treated from a number of different standpoints; results of observations are given with suggestions for protecting buildings. As the subject is of special rather than general interest those who are specially interested are referred to the original.

## TELEGRAPHY, TELEPHONY AND SIGNALS.

*Submarine Cables.*—The "Elec. Friend" (Japan) for June states that a survey is being made by Mr. Asano, the government electrician, between Tokyo and Formosa, for the purpose of preparing for laying a cable, the length of which will be about 1,100 knots and which is roughly estimated to cost $1,500,000.

*Telephony in Japan.*—The following is a list of the number of subscribers at the end of March, 1895, as published in the "Elec. Friend," (Japan) for June: Tokyo, 1,739; Yokohama, 417; Osaka, 451; Kobe, 236.

## MISCELLANEOUS.

*Lightning.*—The "Elek. Anz.," June 15, and the "Elek. Tech.," June 30, reprint from a meteorological journal some recent remarks of Mr. Haepke who is said to be a recognized authority. The frequency of bolts of lightning which have caused fire has increased nearly regularly during the past 30 years and the danger in many districts is now three times as great as it was at that time. Among the causes for this increase he mentions the destruction of the forests, the increased use of iron in buildings and the dust and smoke in the air; the electrical discharge depends very greatly on the geological construction of the earth; when it contains chalk for instance there is seldom any destruction due to lightning, the danger is greater for a sandy soil and greatest for clay. According to the fire statistics for Prussia there were only 13 per cent. of injured buildings, while in villages and country districts the percentage increased to 87. The increased danger due to lightning can be diminished best by a more general use of lightning rods which weaken the difference of potential by the action of their points. The conductivity of a lightning rod is said to be diminished by the introduction of central heating systems, by the introduction of gas and water pipes, etc.; the latter make good connection with the earth and extend up into the houses and consequently are the seat of very high difference of potential and promote discharges; there is therefore greater danger in those portions of houses which contain such pipes; if the lightning rod is well connected with these pipes a discharge can take place without injury; telephone and telegraph wires act effectively as a protection, as they tend to discharge the charge gradually. A commission of experts appointed some years ago in Germany collected statistics and concluded that the connection of lightning rods with gas and water pipes is not only not dangerous but is absolutely essential. In speaking of the power from a ball of lightning, he cites a case in which two wire nails 4 mm in diameter (about a No. 6 B. & S. wire) were melted; experiments made by the Siemens & Halske Company showed that this required a current of 200 amperes at 20,000 volts; assuming that the time of the bolt was only one second, this corresponds to 7,000 hp, or if it lasted 0.1 second it was 70,000 hp.

*Acetylene and Calcium Carbide.*—According to the "Zeit. f. Beleucht.," July 15, the Aluminum Company at Neuhausen (which is manufacturing calcium carbide) states that a recent estimate of the amount of gas produced per pound of calcium carbide by Mr. Wedding, is incorrect; none of the calcium carbide made by them will give less than 250 litres of acetylene per kilogram, and the average is between that and 300; in making a test for this they say that it is not right to use only a small amount of carbide, as the material is not homogeneous. Compared with the incandescent gas light, acetylene, as an illuminant, is not cheaper, and even for enriching gas it is at present still too expensive; for small lighting plants, however, which are not sufficiently near to a central lighting station, acetylene can be used to advantage at the present price; for car lighting and like installations acetylene is preferable to

all other gases; at the price of 50 to 45 centimes (10 to 9 cents, presumably per kg, which is equal to 4.5 to 4.1 cents per pound), at which that company is at present selling it in large lots, 1 cu. m. of acetylene having an illuminating power of about 15 times that of ordinary gas, will cost about 1.70 fr. (34 cents), while the cost of an equal quantity of ordinary gas is 12 centimes (2.4 cents).

*Electricity in Biology.*—"Elek. Tech.," June 15, states that experiments were recently made with the action of electricity and magnetism on germination. The embryos of chickens were placed under the action of a powerful electromagnet and the effect was said to be phenomenal in respect to the number of embryos developed; there was no effect on the eggs of the silk worm; through a pond containing the eggs of trout an electric current was passed, but the result was a negative one, as the development of the embryos seemed to be prevented or at least retarded; Mr. Windl, who appears to have been the authority, concludes that electricity has a more or less detrimental effect, but that no definite conclusions can yet be drawn.

*Magnetic Separation of Iron Ores.*—The "Eng. Mag." for August contains an article by Mr. Ball in which he gives a good discussion of the subject. He discusses the proper treatment, showing, for instance, that the ore should first be separated into three portions, and that which has not been properly separated, re-crushed and separated again; he gives figures showing the advantages of this over the attempt to make a complete separation in one operation. He give figures obtained in practice showing in one case that 95.53 per cent. of the magnetite is saved in the concentration and 4.47 is lost in the tailing, showing the possibility of a conversion of a low-grade non-Bessemer into a high-grade Bessemer ore. In conclusion he states that "we may expect that, with the advent of increasing activity in the iron and steel industry, separated magnetic ore will ultimately fill a most important place in the supply of raw material for this most important industry."

## New Book.

PROCEEDINGS OF THE INTERNATIONAL ELECTRICAL CONGRESS. Held in the city of Chicago, Aug. 21 to 25, 1893. New York: The American Institute of Electrical Engineers; 488 pages, illustrated and with frontispiece portrait group of delegates. Price, $3.

This volume, published by the American Institute of Electrical Engineers, opens with a brief history of the Congress, in which is a full account of its origin and organization. Then follows an account of the opening of the Congress, and a full detailed report of the proceedings. The proceedings of the Chamber of Delegates gives the legislative acts of that body, relating almost wholly to units and standards of measurements, and closes with the full text of the final recommendations as to the values to be assigned to the various units. The general Congress was divided into three sections. The proceedings of each section include the full text of the papers read, and a complete report of the discussions upon them.

Valuable papers were read by members from abroad as well as from this country, and the discussions were participated in by members from all quarters of the globe. It was truly an *International* Congress.

Of some 32 papers, more than half dealt with alternating currents and alternating-current phenomena. Prof. Macfarlane, Mr. Steinmetz and Messrs. Bedell and Crehore gave elaborate analytical treatments of alterna ing-current problems. Other papers related to special alternating-current phenomena. In Section C considerable time was given to the discussion of electrical power transmission where alternating currents came in for much the larger share of attention. Other papers deal with alternating and continuous-current arc lamps, the light and heat of the arc, photometric measurements, variations in the resistance of copper due to temperature, materials for standards of resistance, ocean telephony, signaling through space, electrical laboratories, underground wires, electrostatic voltmeters, etc., etc. The volume closes with a brief résumé of Tesla's lecture on his oscillator, a short account of the banquet, and a report of the proceedings of the final general meeting. The proof-reading was apparently done in haste. In the table of contents, for example, the names of the authors do not follow some of the papers, the initials of others are not given, and an initial is dropped from the name of one.

The following list of titles and authors will indicate the importance of the book:

On the Analytical Treatment of Alternating Currents, by Prof. A. Macfarlane.—Complex Quantities and Their Use in Electrical Engineering, by Chas. Proteus Steinmetz.—General Discussion of the Current Flow in Two Mutually Related Circuits Containing Capacity, by Frederick Bedell, Ph.D, and Albert C. Crehore, Ph.D.—Explanation of the Ferranti Phenomenon by Dr. J. Sahulka.—Measurements of the Energy of Polyphase Currents, by A. Blondel.—Signaling through Space by the Use of Electromagnetic Vibrations, by W. H. Preece.—Ocean Telephony, by Silvanus P. Thompson, D.Sc, F.R.S.—Materials for Wire Standards of Electrical Resistance, by Dr. Stephen Lindeck.—Some Measurements of the Temperature Variation in the Electrical Resistance of a Sample of Copper, by A. E. Kennelly and Prof. R. A. Fessenden.—Note on Photometric Measurement, by Prof. B. F. Thomas.—A Pair of Electrostatic Voltmeters, by Prof. H. S. Carhart.—On a Method of Governing an Electric Motor for Chronographic Purposes, by Dr. A. G. Webster.—Iron for Transformers, by Prof. A. J. Ewing, F. R. S.—London Electrical Engineering Laboratories, by Prof. Andrew Jamieson, M. Inst., C.E., F.R.S.E.—Transformer Diagrams Experimentally Determined, by Dr. Frederick Bedell.—On an Improved Form of Instrument for the Measurement of Magnetic Reluctance, by A. E. Kennelly.—Light and Heat of the Electric Arc, by M. J. Violle.—On the Maximum Efficiency of Arc Lamps with Constant Watts, by Prof. H. S. Carhart.—The Periodic Variation of Candle-Power in Alternating Arc Lights, by Benj. F. Thomas, Ph.D.—New Researches on the Alternating Current Arc, by A. Blondel.—On the Continuous Current Arc and Its Employment as a Photometric Standard, by A. Blondel.—On the Source and Effects of Harmonics in Alternating Circuits, by H. A. Rowland.—Rotary Mercurial Air Pumps, by Dr. F. Schulze-Berge.—Underground Wires for Electric Lighting and Power Distribution, by Prof. Dugald C. Jackson.—Various Uses of the Electrostatic Voltmeter, by Dr. J. Sahulka.—A New Incandescent Arc Light, by Prof. L. B. Marks.—Direct Current Dynamos of Very High Potential, by Prof. Francis B. Crocker.—Multiphase Motors and Power Transmission, by Dr. Louis Duncan.—Exhibit of Tesla Polyphase System at the World's Fair, by C. F. Scott.—Discussion of Power Transmission, by Dr. L. Bell, L. B. Stillwell, Prof. S. P. Thompson, Prof. Forbes, C. P. Steinmetz, Prof. Rowland, C. S. Bradley, Dr. N. S. Keith, Prof. D. C. Jackson, H. Lemp and W. F. C. Hasson.—A Novel Method of Transforming Alternate into Continuous Currents, by Dr. Chas. Pollak.—Note on the Variation of Capacity of Insulated Wires with Temperature, by Herman S. Hering.—The Tesla Mechanical and Electrical Oscillators.

The book is well printed on heavy paper, and forms an excellent, permanent record of the most important of the electrical congresses ever held. The library of no one interested in electrical science can be considered complete which does not include this work.

## A Condenser Telephone Receiver.

A most interesting practical application of the condenser to the reproduction of speech has been made by William Marshall, of 709 Lexington Avenue, New York, whose condensers are known throughout the electrical trade on both sides of the Atlantic. This instrument, while in an experimental form, attracted much attention from several eminent visitors to the World's Fair in 1893, Prof. E. Mascart, in particular, having manifested marked interest in it.

Fig. 1 shows Mr. Marshall's latest type of receiver dismantled. It consists simply of a small circular condenser mounted in a rubber case; the condenser comprises a number of annular tinfoil sheets, each having a projecting lug, laid between similar sheets of manilla paper in such manner that the lugs of alternate foil sheets coincide with each other. The sheets are clamped at the edge between the two halves of a wooden ring which has terminal strips coinciding with the two groups of tinfoil lugs, and adapted to make electrical connection with them. When the condenser is placed within the case the terminals on the wooden ring make connection with contact strips leading to the binding posts

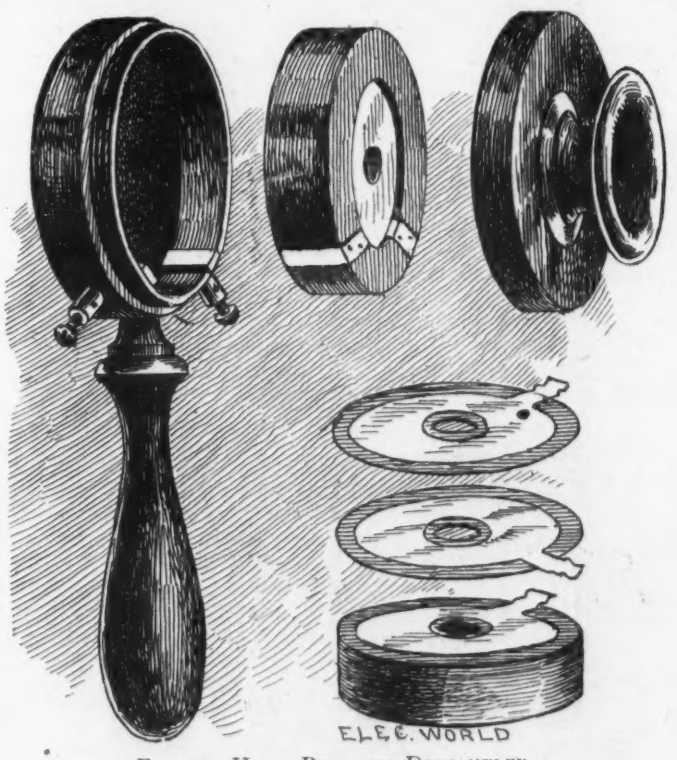



FIG. 1.—HAND RECEIVER DISMANTLED.

of the instrument, so that no wires are used for interior connections, and the connections are made or broken naturally in the operation of assembling or dismantling the receiver. There is no diaphragm, and no adjustment is necessary. Any transmitter may be used, but Mr. Marshall prefers to use a carbon transmitter of his own design, the condenser-

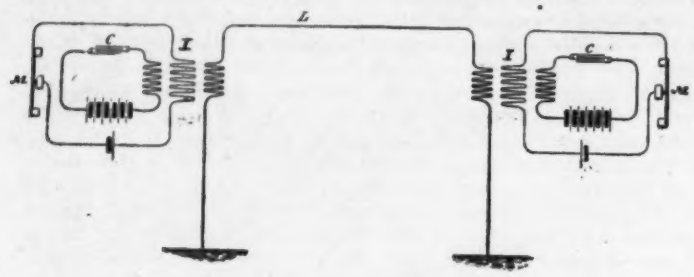



Fig. 2.—Circuit Connections.

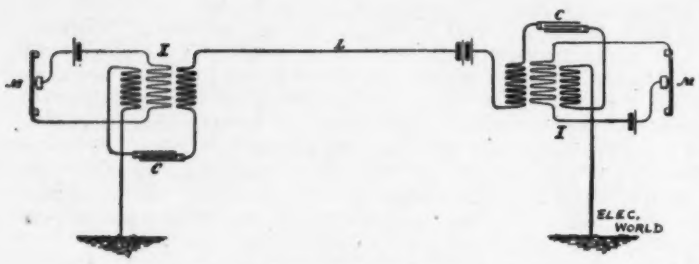



Fig. 3.—Circuit Connections.

telephone not serving so well as a transmitter in the present state of development. Fig. 2 shows diagrammatically the circuit connections; *M* represents the transmitter; *L*, the line connecting two stations; *C*, the condenser-receiver, and *I*, the induction coil, which has, in this system, three windings in ead of two, as is commonly the case. A comparatively strong battery is connected in circuit with the condenser and one of the windings of the induction coil, while the usual single cell is included in

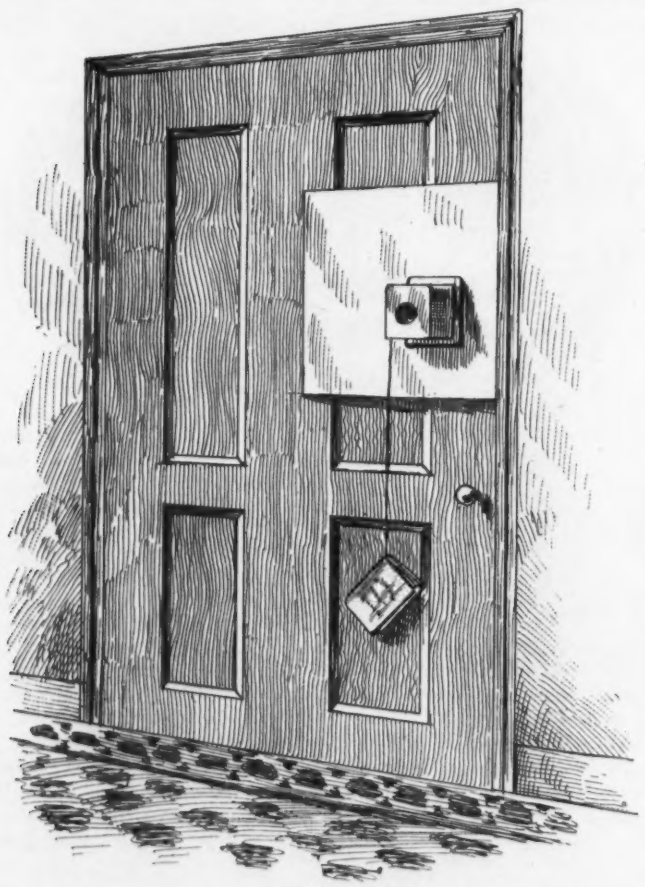


Fig. 4.

the transmitter circuit. Fig. 3 shows another arrangement of connections by which the heavier battery is not required at both stations, but is put directly in the main line. This is better adapted for exchange service, in which case the battery can be at the exchange instead of at both the exchange and subscriber's station, as would necessarily be the case if the plan shown by Fig. 2 were used.

Mr. Marshall states that in a test made some time back over a telegraph line between St. Paul and Duluth, Minn., which contained a number of relays, conversation was carried on with entire clearness, whereas not a sound could be heard when an ordinary telephone receiver was used. On another occasion these instruments were tested on a line between Albany and Saratoga Springs, and in this case the receivers were not held to the ear but laid on a table and the conversation was distinctly heard by all in the room.

The first experience one has with one form of this instrument produces a somewhat startling effect. Upon the door of Mr. Marshall's office is suspended a plain, every-day sort of pamphlet, apparently a price-list, hung by a cord from a telephone transmitter box, as shown in Fig. 4, with nothing whatever in view to indicate that its function varies from that of any other catalogue. Upon approaching the book, however, the visitor is not a little perplexed by hearing a distinct whistling sound emanating from it, and taking hold of it gingerly by the extreme back edge of the binding one is invited to "Open me, and I'll talk just the same," which almost has the effect of causing the thing to be dropped, The flow of words continues unabated, regardless of the bending, rolling or opening of the pamphlet, in a tone audible 15 feet away. A closer inspection of the book reveals the fact that it differs from other books in having a strip of tin foil pasted on each leaf, every alternate strip being electrically connected, as in ordinary condensers, and the two series of strips being connected to the duplex flexible cord by which the book is suspended.

These condenser-receivers articulate most distinctly when the leaves lay together loosely, or touch at the edges and are separated in the centre. This condition is secured in the regular instrument shown in Fig. 1 by clamping the edges of the foil rings tightly in the wooden ring, which causes the centres to buckle slightly; the book-receiver fulfills the condition nicely by reason of its natural construction and the tendency of the leaves to stand a little apart at the edge farthest from the binding. The position of the book does not affect the articulation, however; the enunciation is equally clear with the book hanging from its cord, laying on a hard or soft substance, rolled up in one's hand, or opened wide, the tones reproduced being perfectly distinct at a distance of 12 or 15 feet. When this pamphlet is held against one ear and the hand-receiver above described is applied to the other, the conversation of a person at the other end of an artificial line of about 200,000 ohms resistance is so loud as to be uncomfortable.

It may here be added, that as a maker of condensers Mr. Marshall has an international reputation. His multiple-series condenser was adopted, without any solicitation on his part, by the American Bell Telephone Company as the standard apparatus for use in testing cables, and none is accepted until proven satisfactory with a Marshall multiple-series condenser.

## A Thriving Repair Shop.

An excellent illustration of the result of a conservative but energetic business policy, coupled with close, careful attention to details, is to be found in the busy works of the Chesley Electric Company, 601 to 605 Newark Street, Hoboken, N. J. Beginning in 1892 with one lathe and a single workman, Mr. W. S. Chesley, the head of the present concern, took up general electrical repair work with the determination to succeed if hard work and conscientious dealing availed anything.

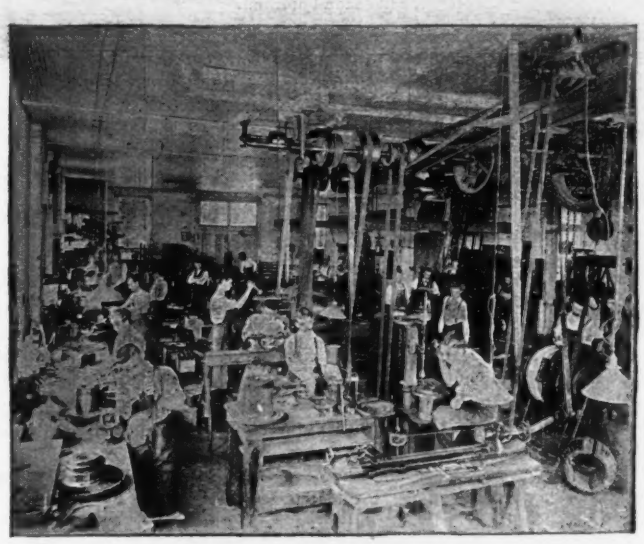
Business came in slowly at first, then in greater volume as the merits of

Winding Room.

the work done began to be appreciated by central station men and others who had "lame" armatures or "sick" field magnets to be overhauled. Machine tools and workmen were added gradually in order to keep pace with the constantly increasing patronage, until now the works fully occupy the 75x85 feet building in which they are located, comprising a full complement of lathes, planers, shapers, milling machines, drill

presses and bench tools, which are being constantly added to as the requirements of the business justify. Twenty-two men are now employed, and the shops are kept open day and night so as to accommodate emergency jobs, regardless of the hour at which they are brought in the works.

The accompanying illustrations give partial views of the interior of the works, which present a busy, thriving appearance to the visitor, and have



VIEW OF MACHINE SHOP.

ample facilities for handling machinery of every class, from large railway generators to fan motors. The company has just arranged for the manufacture of a line of bipolar dynamos and motors, from ½ to 50 hp, of the inverted horse-shoe type, having wrought-iron field magnets. These machines will be ready for the market within a very short time.

## Tests of Incandescent Lamps.

Prof. B. F. Thomas, of the Ohio State University, recently finished some extended tests of the Packard incandescent lamps, the object of which was to determine its candle-power and efficiency at suitable intervals during a period of at least 600 hours. We print below an account of these tests as given by Prof. Thomas, in a report which forms a notable addition to the literature of the incandescent lamp.

Owing to the lamps being received too late to allow a test of the necessary length at the University before its close for the Summer, the initial measurements only were made there, and an arrangement with the local Edison Electric Company made to place the lamps on circuit at its central station for the life run. The test circuit and photometer were set up and used in the lamp store room at this station.

Weston instruments were used for the electric readings—a milliammeter reading to .001 ampere for current strengths, and a voltmeter reading to .1 volt for E. M. F., the instruments being carefully compared with the University standards. For candle-power readings, a Summer-Brodhun sighting box was adapted to an accurately graduated portable photometer bar, 100 inches long. The lamp under test was placed at one end of the bar, and a 100-volt 16-cp lamp, which had been used some time, was placed at the other end and used as a working standard. This lamp and three similar check lamps were first carefully measured on the University standard photometer, against a Harcourt pentane lamp, whose value was well known from many series of comparison with the best sperm candles. During these tests, the incandescent lamps were supplied with current from a good storage battery. Electric readings were taken with the Weston instruments named above. All photometer readings, at the University and at the station, were made by Prof. Thomas. At least four settings were taken for each reading, and the sighting box was severed after each setting. Successive settings seldom differed by more than one per cent. The electric readings were taken by two experienced students, Messrs. A. H. Jones and R. D. McCarter, Jr.

One hundred lamps, labeled "16-cp, 100 volts," were received, being about equally divided into two lots, having distinguishing marks inside the bulbs. Twenty-five lamps were taken at random from each lot for test. In order that the lamps might be run at as nearly constant voltage as possible, wires were run to the test room from the station circuit, which is brought back from the junction box at the mains of the general lighting system of the company. The mains were kept at as nearly constant potential as possible by an attendant at the switchboard, who was guided by the readings of a Weston voltmeter attached to pressure wires from the mains. It unfortunately happened that at a point between the mains and the station, a motor was run from the station circuit which supplied current for the test. The running of this motor caused momentary abnormal changes in voltage during the day, but at night it was not running, and the voltage was then quite steady. If the lamp circuit had been run from the station switchboard, it would have been necessary to provide for constant watching and regulation of the lamp voltage. As already stated, the voltage was not perfectly constant, and no attempt was made to secure unusual constancy for the reason that the circuit arrangement used enabled the lamps to be worked under the conditions ordinarily existing in central station practice. The results may, therefore, be considered as a better indication of what lamp users may reasonably expect from similar lamps, than if the lamps had been run at an unvarying voltage.

The 50 lamps were mounted, vertically downward, in four rows of keyless wall receptacles, wired at the middle of each row to a common point, and provided with a double pole switch and with fuses. The standard station voltage being 110, an iron wire resistance was inserted in one of the wires leading to the lamp rack, and adjusted so as to secure as nearly as possible 100 volts at the lamp terminals. No recording voltmeter was available, and no one was present throughout the whole of any day, and it is therefore impossible to say exactly what the average voltage was. From readings taken on different days and at different times of day, it is thought that the average voltage was about 99.

The photometer was carefully enclosed and thoroughly screened with dead black cloth, to cut off all indirect and reflected light. The rheostat used enabled the one observing the voltmeter to adjust the voltage very closely, when taking photometer readings. The lamp under test and the standard lamp were arranged in parallel, and wired with No. 14 wire, and all connections carefully made, so that there should be no appreciable drop or fall of potential in the wires or connections, the absence of such drop being verified by proper measurements. While these measurements were being taken, the voltmeter needle was often unsteady, obliging the observers to wait for periods when it was steady at the proper reading, before current readings could be made. The arrangement of the lamps in parallel, as adopted, made it unnecessary to wait for such periods of steady and proper voltage before taking the photometer readings; the slight momentary variations of voltage from the correct value affected the candle-power of both lamps alike within the range allowed in reading. The work was thus more rapidly done than otherwise would have been possible. This very convenient method is largely used in lamp factories, but it is a safe method only in case the voltage is quite steady, or the lamps under test are of the same efficiency as the working standard. If the test lamp's efficiency differs much from that of the standard, the ratio between the candle-powers of the test and standard lamps will vary with varying voltage. If their efficiency is the same, the candle-power ratio will be constant, though the voltage may vary.

The following tables and curves give the results obtained. Tables I. and II. give, for each of the lots I. and II., the number of lamps burning,

TABLE I.—AVERAGE OF LOT NO. I.

| Hours from start of test. | Number lamps burning. | Candle power. | Percent'ge of initial cp. | Watts per lamp. | Watts per cp. | Candle power per watt. |
|---|---|---|---|---|---|---|
| 0 | 25 | 15.54 | 100 | 61.00 | 3.93 | .254 |
| 196 | 25 | 17.58 | 113.2 | 63.12 | 3.59 | .270 |
| 144 | 25 | 17.84 | 115.0 | 63.62 | 3.57 | .280 |
| 192 | 25 | 17.82 | 115.0 | 63.54 | 3.57 | .280 |
| 252 | 25 | 17.53 | 113.0 | 63.55 | 3.63 | .275 |
| 312 | 25 | 17.30 | 111.4 | 63.41 | 3.66 | .273 |
| 360 | 24 | 17.04 | 110 0 | 63.21 | 3.70 | .270 |
| 408 | 24 | 17.08 | 100.0 | 63.30 | 3.70 | .270 |
| 480 | 24 | 16.68 | 107.5 | 63.00 | 3.78 | .265 |
| 528 | 24 | 16.70 | 107.5 | 62.73 | 3.76 | .266 |
| 600 | 24 | 16.35 | 105.3 | 62.64 | 3.83 | .261 |
| 648 | 23 | 16.07 | 103.4 | 62.60 | 3.90 | .256 |
| 496 | 22 | 15.83 | 102 0 | 62 60 | 3.95 | .253 |
| 768 | 22 | 14.81 | 95.3 | 61.94 | 4.17 | .240 |
| 812 | 22 | 14.50 | 93.3 | 61.51 | 4.24 | .236 |

TABLE II.—AVERAGE OF LOT NO. II.

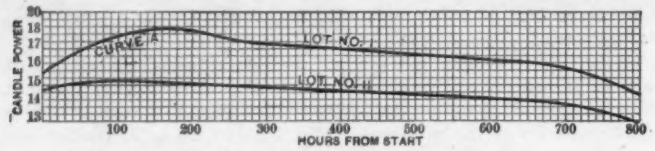
| Hours from start. | Number lamps burning. | Candle power. | Percentage of initial cp. | Watts per lamp. | Watts per cp. | Candle power per watt. |
|---|---|---|---|---|---|---|
| 0 | 25 | 14.77 | 100 | 49.60 | 3.36 | .298 |
| 96 | 25 | 15 06 | 102 | 50 00 | 3.32 | .301 |
| 144 | 25 | 15.13 | 102.5 | 50.23 | 3.32 | .301 |
| 192 | 25 | 15.01 | 101.8 | 49.96 | 3.30 | .303 |
| 252 | 25 | 14.93 | 101.2 | 50.10 | 3.35 | .299 |
| 312 | 24 | 14.85 | 100.5 | 49.78 | 3.35 | .299 |
| 360 | 24 | 14.82 | 100.3 | 49.76 | 3.36 | .298 |
| 408 | 24 | 14.67 | 99.3 | 49.70 | 3.39 | .295 |
| 480 | 24 | 14.65 | 90.2 | 49.52 | 3.39 | .295 |
| 528 | 24 | 14.70 | 99.3 | 49.31 | 3.36 | .298 |
| 600 | 24 | 14.50 | 98.2 | 49.33 | 3.40 | .294 |
| 648 | 24 | 14.16 | 96.0 | 49.00 | 3.46 | .289 |
| 696 | 24 | 13.87 | 94.0 | 48.92 | 3.53 | .283 |
| 768 | 24 | 13.29 | 90.0 | 48.50 | 3.65 | .274 |
| 812 | 24 | 12.97 | 88.0 | 48.25 | 3.72 | .269 |

the observed candle-power (average of each lot), and the average watts per lamp, at the several times at which readings were taken. From these readings, the percentage of initial candle-power, the efficiency and the candle-power per watt, were computed and inserted in the tables.

The first readings at the test room were taken with a Sabine portable photometer 48 hours after starting the life run. The sensitiveness of this

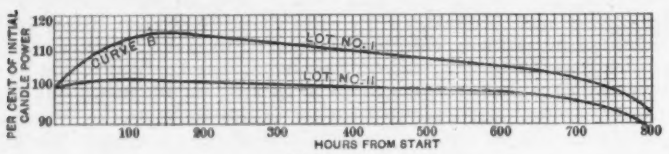
instrument was so inferior, and the readings obtained so much less uniform than those obtained with the Summer-Brodhun sighting box on the standard photometer during the initial measurements, that they were discarded. The Summer-Brodhun instrument was then adapted to the bar at the test room, and used in all subsequent readings, and is without doubt the best instrument yet devised for its purpose.

The values of Tables I. and II. are plotted in terms of candle-power and time in curve *A*, of percentage, initial candle-power and time in curve *B*, and of efficiency and time in curve *C*. As shown by these




Curve A.

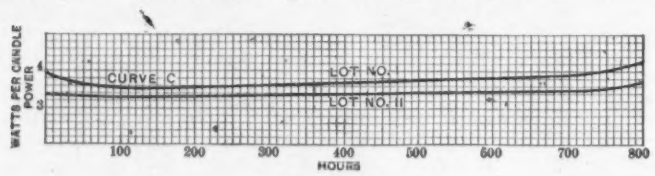
curves, Lot I. shows a marked increase in candle-power on the start, reaching a maximum of 17.9 candles at about 175 hours, then decreases uniformly until 600 hours, when a more rapid decrease sets in. The candle-power does not fall to its initial value of 15.54 candles until over 700 hours from the start. Lot II. shows only a moderate rise in candle-power, with a maximum at about 150 hours, and then decreases uniformly to its initial value at 400 hours. It shows also a sharp increase in declining brightness at 600 hours. This change may have been produced by strain due to abnormally high voltage at soon after the 600-hour point.




Curve B.

Such a high voltage was observed for some time during the day preceding the evening on which the readings at 696 hours were taken, and its effect on the candle-power of Lot I. was particularly marked though less so than on Lot II. Curve *B* shows a rise of over 15 per cent. in the candle-power of Lot I., with a final value of only 6.5 per cent. below the initial value. The total range in candle-power, from beginning to end, is 22 per cent. for Lot I., and 14.5 for Lot II.

Curve *C* shows a marked increase in efficiency for Lot I. on the start, falling back to the initial value only after 600 hours. Lot II. improves in efficiency also on the start, though to a small extent, and continues at a

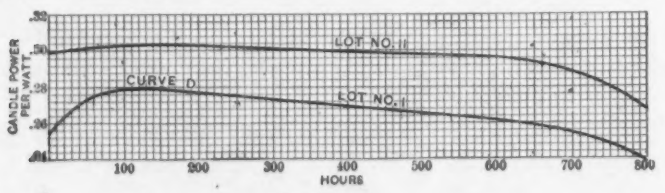



Curve C.

practically uniform figure for 600 hours. The decrease in efficiency of each lot after 600 hours is much less rapid than that usually met with.

Tables III. and IV. give the total kilowatt-hours spent on each lot of lamps, and the total candle-power-hours obtained from them from the start up to the times given in the first columns of the tables.

These values were obtained by taking average values from curves *A* and *C* (enlarged) for each 100-hour interval, multiplying by the number of lamps then burning, and by 100 hours, and adding the product to the sum of all products similarly found for the preceding 100-hour intervals from the start to the given time. The total cost of the light produced up to




Curve D.

a given time was found by multiplying the kilowatt-hours used at that time by an assumed price of 20 cents per kilowatt-hour,—a common price. This gave the cost of current only. To this was added the cost of 25 lamps at 20 cents each, or $5, the sum being the total cost of light produced. The results are given in Column 4. The average cost of one candle-power for one hour at each interval was then found by dividing the total cost thus found by the total amount of light produced. Column 5 gives the results. These results are plotted in curve *E* for each lot.

Examining these curves, it will be noted that the lamps in Lot I. show a minimum average cost of the light produced by them, under the conditions assumed, at about 450 hours. Lot II. shows a minimum, under the same conditions, at 650 hours. The difference in cost of light produced by the two lots, at the minimum point for each lot, is about 7 per cent. in favor of Lot II. On comparing I. and II., curve *B*, it will be observed that the range in candle-power of Lot I., up to 450 hours, is about 15 per cent., while that of Lot II. is only 6½ per cent. up to 650 hours. Lot II. is better than Lot I. on this account also, as uniformity of candle-power is desirable, other things being equal.

TABLE III.—LOT I.—ECONOMIC RESULTS.

Cost of light based on assumed price of 20 cents per lamp, and 20 cents per kw-hour. Figures in last column obtained by dividing cost in fourth column by corresponding figures in second column.

| Hours from start. | Total candle power-hours. | Total kilowatt-hours. | Total cost of light. | Average cost in cents of one cp-hour. |
|---|---|---|---|---|
| 100 | 41,500 | 155.25 | $36.05 | .0869 |
| 200 | 89,950 | 314.00 | 67.80 | .0754 |
| 300 | 133,870 | 472.80 | 99.56 | .0744 |
| 400 | 175,930 | 628.0 | 130 60 | .00742 |
| 500 | 216,470 | 779.3 | 160.86 | .0743 |
| 600 | 256,290 | 929.9 | 190.98 | .0746 |
| 700 | 292,100 | 1071.2 | 219.24 | .0751 |
| 800 | 325,500 | 1207.7 | 246.54 | .0757 |

One may readily obtain the economy curves of these lamps under other conditions by treating the figures in the second and third columns of Tables III. and IV. as was done above, for the price of lamp and energy here used. The prices used were chosen because they fairly represent lamp cost and cost of energy as supplied by central lighting stations in this country to-day. Higher prices for lamps, or a lower price per kilowatt-hour, will bring the "smashing point" for either lot later than the times named, though no change in the relative value of the two lots will follow if compared under like conditions.

TABLE IV.—LOT II.—ECONOMIC RESULTS.

Cost of light as based on an assumed price of 20 cents per lamp, and 20 cents per kw-hour. Figures in last column obtained by dividing cost of light in fourth column by corresponding figures in second column.

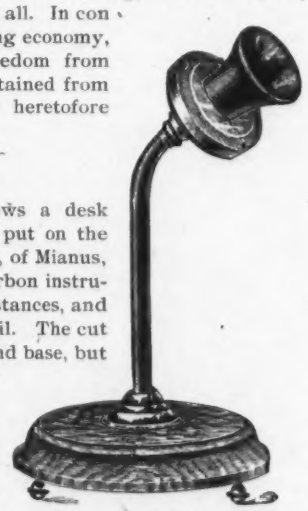
| Hours from start. | Total candle-power hours. | Total kilowatt hours. | Total cost of light. | Average cost in cents of one cp-hour. |
|---|---|---|---|---|
| 100 | 37,320 | 124.50 | $29.90 | .0801 |
| 200 | 75,020 | 249.90 | 54 98 | .0733 |
| 300 | 112,370 | 374.80 | 79.96 | .0712 |
| 400 | 147,940 | 494.20 | 103.84 | .0702 |
| 500 | 183,220 | 613.20 | 127.64 | .0697 |
| 600 | 218,170 | 731.70 | 151.34 | .0694 |
| 700 | 252'130 | 894.40 | 174.88 | .06936 |
| 800 | 284,360 | 966.10 | 198.22 | .0698 |

For isolated plant work the net cost of energy is considerably decreased and may be taken at less than 10 cents per kilowatt-hour, in some cases as low as 6 cents. For such work the computed cost curves will show a minimum at or beyond 800 hours. The "smashing point" will in such cases not be the question of cost of light produced, but the decrease in candle-power of the lamps being reached when the light produced by the lamps is no longer satisfactory.

No lamp of either lot showed any serious blackening, and the majority of the lamps were scarcely blackened at all. In conclusion, Prof. Thomas states that, taking economy, maintenance of candle-power and freedom from blackening into account, the results obtained from these lamps are much superior to any heretofore published.

## A New Desk Telephone.

The accompanying illustration shows a desk telephone transmitter which is being put on the market by the Mianus Electric Company, of Mianus, Conn. The transmitter is a granular carbon instrument, adapted for both long and short distances, and the base contains the usual induction coil. The cut shows only the transmitter, standard and base, but when desired a push-button call, buzzer and telephone receiver are attached, forming a complete set. The arrangement is a very compact and handy one, and its weight is not so great as to make it a burden to move around from one part of a desk to the other. A convenient disposition of the full set is to hang the receiver at the end of the desk, providing it with an extra long cord, and restrict the portable portion to the transmitter, induction coil and switch. The buzzer or call bell can obviously be placed at any point within earshot.



Desk Transmitter.

# NEWS OF THE WEEK

## Financial Intelligence.

### THE ELECTRICAL STOCK MARKET.

NEW YORK, Aug. 10, 1895.

AMERICAN BELL was slightly stronger this week, ranging from 196 to 197½. The entering of suits by the company against competitors, on the ground of infringement of the Berliner patent recently reinstated, has probably had some strengthening effect.

ELECTRIC STORAGE continued on a tremendous boom, selling up to 45 on Tuesday. It was regarded as significant that demand for the stock ran in small lots, suggesting that the public is not slow to grasp the opportunity for profit likely to be shown in a large way as the business of the company develops. Nor is there any question that the company's business is already forging ahead in a way pleasing to its most sanguine friends.

WESTINGHOUSE stock was not appreciably affected by the alliance consummated this week between the Westinghouse Company and the Baldwin Locomotive Works, remaining almost stationary at 36½. The company is reported as doing a fine business, which will naturally be augmented by reason of the arrangement with the Baldwin Works. It is stated on good authority that the saving in operating expenses in the new works as compared with results formerly obtained will net about $30,000 per month, which obviously represents the interest on $6,000,000, while the shops cost about $1,500,000.

ELECTRICAL STOCKS.

| | Par. | Bid. | Asked |
|---|---|---|---|
| Chicago Edison Company | 100 | 120 | 125 |
| Edison Electric Ill., New York | 100 | 97 | 99 |
| " " " Brooklyn | 100 | .. | 108 |
| " " " Boston | 100 | 129 | 130 |
| " " " Philadelphia | 100 | .. | 115 |
| Edison Ore Milling | 100 | 13 | 15 |
| Electric Storage Co., Philadelphia | 100 | 42 | 43 |
| General Electric | 100 | 37¼ | 37½ |
| General Electric, pref | 100 | 69 | 71 |
| Westinghouse Consolidated, com | 50 | 36 | 37 |
| " " pref | 50 | 53 | 54 |

BONDS.

| | | | |
|---|---|---|---|
| Edison Electric Ill., New York | 105 | 105½ | 105½ |
| Edison Electric Light of Europe | 100 | 75 | 85 |
| General Electric Co., deb. 5s | 100 | .. | 90¼ |

TELEGRAPH AND TELEPHONE.

| | | | |
|---|---|---|---|
| American Bell Telephone | 100 | 197 | 198 |
| American District Telegraph | 100 | 33 | 40 |
| American Telegraph & Cable | 100 | 97 | 100 |
| Central & South American Telegraph | 100 | 117 | 120 |
| Commercial Cables | 100 | 150 | .. |
| †Erie Telephone | 100 | 56 | 56¼ |
| Gold & Stock Telegraph | 100 | 105 | .. |
| New England Telephone | 100 | 87 | 87¾ |
| New York & New Jersey Telephone | 100 | 103 | 105 |
| Postal Telegraph-Cable | 100 | 63½ | .. |
| Western Union Telegraph | 100 | 94 | 94¼ |

ELECTRIC TRACTION STOCKS.

| | | | |
|---|---|---|---|
| Baltimore Traction | 25 | 20 | 20½ |
| Binghamton RR. com | 100 | 100 | .. |
| Brooklyn Traction | 100 | 17 | 19 |
| " " pref | 100 | .. | 53 |
| Buffalo St. Ry | 100 | 85 | 88 |
| Cleveland City Ry | 100 | 69 | 70 |
| Cleveland Electric Ry | 100 | 59 | 60 |
| Chicago City Ry | 100 | 305 | 315 |
| Columbus St. Ry | 100 | 48½ | .. |
| Consolidated Traction of N. J | .. | 26 | 30 |
| ‡Electric Traction, Philadelphia | 50 | .. | 74 |
| Hestonville | 100 | 58 | 58½ |
| Long Island Traction, 1st in pd | 100 | 16½ | 16¾ |
| Louisville St. Ry. com | 100 | 37 | 39 |
| " " " pref | 100 | 87 | 88 |
| New Orleans Traction | 100 | 24 | 27 |
| " " pref | 100 | 69 | 71 |
| North Shore Traction | 109 | 34½ | 37 |
| " " pref | 100 | 84 | 88 |
| People's Tractic $30 pd | 25 | 65½ | 66 |
| Philadelphia Traction | 50 | 84¾ | 84⅞ |
| Rochester St. Ry | .. | 38 | .. |
| Union Ry. (berry) | 100 | 112 | 115 |
| West End, Boston | 100 | 75½ | 76 |
| " " pref | 100 | 92 | 92½ |
| Worcester Traction | 100 | 18 | 20 |
| " " pref | 100 | 86 | 90 |

BONDS.

| | | | |
|---|---|---|---|
| Buffalo St. Ry. 1st con. 5s | 100 | 106 | 109 |
| *Binghamton Railway Co. 5s | 100 | 99 | 100 |
| *Columbus St. Ry. 1st 5s | 100 | 104 | .. |
| Rochester St. Ry. 1st 5s | 100 | 95 | 97 |
| *Union Ry. 1st mtge 6s | 100 | 105 | 108 |
| *Westchester Electric 1st mtge 5s | 100 | 98 | 101 |

* With accrued interest.
† Ex-Div.
‡ Ex-rights.

UNION TRACTION.—Persons who are supposed to be in close touch with President Welsh of the Union Traction Company, declare that the company will begin business with a paid-up capital of about $10,000,000. The understanding is that of this amount the People's Traction Company will turn over $1,200,000 bonds it has in its treasury, and the Electric Company will deposit its holdings of the Lehigh Avenue road, amounting to 10,001 shares, while the Philadelphia Traction Company will surrender the bulk of the stock of the Seventeenth and Nineteenth Street roads, Empire, Union, West Philadelphia Passenger Railway and others, having a market value of over $6,000,000—making the total value of securities to be placed in the treasury of the new company $7,700,000, which, added to the $3,000,000 to be derived from the first call on the stock, will make the aggregate capital $10,700,000. From this will be deducted about $3,000,000 for improvements now under way and in contemplation.

## Special Correspondence.

### NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Aug. 12, 1895.

A NEW FIVE-STORY BUILDING, to be erected in connection with the Museum of Natural History, will be equipped with a new electric plant to consist of a 150-hp engine and a 100-kw dynamo, with wiring, etc. Bids for the construction of the above will be received until Aug. 14.

LIGHTS ON THE BOULEVARD.—Experiments were made last Monday night with electric lights from Church Lane, Flatbush, for a distance of over a mile toward Coney Island. The naphtha lamps which have been in use for several weeks are very much in disfavor. The general opinion is that the electric lights are by far the best.

DISSOLUTION OF PARTNERSHIP.—The firm of Noll & Sibley, manufacturers' agents, has been dissolved, Mr. Noll withdrawing in order to accept an exceedingly flattering offer in another line of business. Mr. Sibley will continue to represent prominent manufacturers of electrical supplies, with headquarters at the same address—Postal Telegraph Building. The style of the new firm is C. C. Sibley & Co.

BROOKLYN'S FIRST TROLLEY PARTY.—The mild Philadelphia diversion of riding in an illuminated trolley car was tried in Brooklyn for the first time on last Wednesday night. Six trolley cars of the Brooklyn Heights Railway Company were sent down to Ulmer Park bearing a load of guests. The cars were hung with flags and bunting and brilliant with electric lights. Each car was illuminated in red, white and blue, with more than one hundred lights. The cars met at the City Hall shortly after 8 o'clock, and thence proceeded in a line along Court Street to Bensonhurst. There was a crowd at the City Hall to see them start, and the trip through the city was made to the accompaniment of great enthusiasm from the small boys who were gathered to see the procession pass. Ulmer Park was reached in less than an hour. There was a banquet there for the directors of the road and their guests. Among these were ex-Gov. Flower, ex-Lieut. Gov. Sheehan and Silas Dutcher. There were more than 300 persons in all. The cars presented a very attractive appearance, and if they are always as much appreciated as they were Wednesday night, the illuminated trolley is likely to become as popular an entertainment in Brooklyn as it is said to be in Philadelphia.

### WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Aug. 10, 1895.

H. J. GILLE, who has for a number of years been identified with General Electric interests, has resigned to accept a position with the Washburn & Moen Manufacturing Company, with headquarters at St. Paul. He will enter upon his new line of work about Aug. 15.

THE MARKED SUCCESS of the recently-built American Steamship *St. Louis* is worthy of comment, and her electric equipment is up to date and has many special features, one of which is a special marine switch which was designed for the ship by the Bryant Electric Company, of Bridgeport, Conn. The switch is a single-pole, ten-ampere, in a metal case with a porcelain base, the holes for the wires being protected by porcelain bushings, and the whole covered with a metal top, the handle of the switch projecting. This device was designed for places where an exceedingly strong switch is desired, and is admirably adapted for lake or ocean service, or any place where the conditions demand strength and protection from moisture. Grier Brothers, the Western managers of the Bryant Electric Company, will keep these switches in stock in the company's storerooms, Monadnock Building, Chicago.

THE TOLEDO TRACTION COMPANY, Toledo, O., has let the following contracts for its new station equipment: Four engines aggregating 4,000 hp to the American Wheelock Engine Company, Chicago; two 500-hp boilers to the Heine Safety Boiler Company, St. Louis; two 1,000-hp economizers to the Fuel Economizer Company, of Matteawan, N. Y.; six furnaces to the Hawley Down-Draft Furnace Company, of Chicago, Ill.; four 800-hp rope drives (of the Hoad-

ley system) to the American Wheelock Engine Company; one 20-ton traveling crane to the Brown Hoisting Company, of Cleveland, O.; three 500-kw direct-coupled railway generators to the General Electric Company. The machinery contracts yet to be let are for shaftings and pulleys, four air pumps, piping system and coal and ash conveying machinery. Sargent & Lundy, Chicago, are the consulting engineers.

## Canadian Notes.

OTTAWA, August 9, 1895.

OTTAWA, ONT.—A new power house is to be erected in connection with the Lachine Rapids Hydraulic Company.

MANHEIM, CAN.—A new electric light plant is to be built here. Address Chief Burgess Von Berger for information.

ST. THOMAS, ONT.—Sealed proposals will be received until Aug. 22, for lig hting the streets of the city with electricity. A. W. Campbell is city engineer.

OTTAWA, ONT.—G. P. Brophy, vice-president of the Ottawa Electric Street Railway Company, last week lost three sons, aged 23, 19, and 14 years, respectively, through an accident on the Deschene Lake near this city.

OTTAWA, ONT.—Correspondence of a very satisfactory character has been passing between the British and Canadian governments regarding the voting of an imperial subsidy for the extension of the cable running from Halifax to Bermuda to other points in the British West Indies.

TRENTON, ONT.—The Trenton Light, Heat & Power Company, with a capital of $50,000, is applying to the Ontario government for a charter for the purpose of supplying electric light, heat and power to the town of Trenton. L. L. Merrifield, J. T. Westcott, M. M. Thompson and W. H. Pearson to be first directors.

NIAGARA FALLS, ONT.—The International Belt Line Railway Company of Niagara Falls, is applying to the Ontario government for a charter for the purpose of constructing electric street railways in Stamford and the town and village of Niagara Falls. The capital of the company is to be $500,000. A. E. Schoellkoff, H. C. Neilson, J. M. Bruiker, John Bender and Wm. Kyle are to be the first directors.

ST. CATHARINE'S, ONT.—The new factory of the Packard Electric Company, Ltd., is in full operation, and the company is turning out large quantities of incandescent lamps and transformers. Mr. W. D. Packard has decided to give the business his personal attention, and has therefore taken the general managership. He will be ably assisted in the management of the company's affairs by Mr. G. A. Powell. The new factory is equipped throughout with new machinery of a superior type, so that the company is now in a most excellent position to turn out the highest grade of apparatus at moderate prices.

## English Notes.

[FROM OUR OWN CORRESPONDENT.]

LONDON, July 30, 1895.

MUNICIPAL ELECTRIC LIGHTING OF LIVERPOOL.—The Liverpool Town Council, after some negotiation, has purchased the undertaking of the Liverpool Electric Supply Company for the sum of £400,000.

CITY & SOUTH LONDON RAILWAY.—This company has paid a dividend at the rate of 1⅛ per cent. per annum for the half year ending June 30, with £965 carried forward. This compares with 1 per cent. per annum for the corresponding period last year, with £1,335 carried forward.

CITY LIGHTING.—The financial press has blossomed out this week into attractive paragraphs announcing the imminent payment of a 10 per cent. dividend by the City of London Electric Lighting Company. It is to be hoped that this good news is true, and that the announcement does not portend the demand for more capital, for capital which is subscribed for under the impulse of the payment of a big dividend, does not, as a rule, itself prove particularly remunerative.

ELECTRIC LIGHTING FRANCHISES.—In the last report made by the Board of Trade to Parliament, it is stated that during the current year 29 applications for electric franchises came before the Board of Trade, 23 of these being granted. The total number of electric lighting franchises now in existence in the United Kingdom amounts to 210, of which no less than 142 or 67 per cent. are held by local authorities. The total number of electric light undertakings actually at work or in progress amounts to 112.

TELEGRAPHIC COMMUNICATION WITH LIGHTHOUSES.—Last week telegraphic communication was effected with the Fastnet Light on the discontinuous cable system. The laying of the cable from the shore was undertaken by the Post Office Department and was carried out by the telegraph ship *Monarch*, the cable ending in a heavy copper ring secured to the bottom, as near the rock on which the lighthouse stands as possible. On the rock two heavy copper cables have been laid down. The telegraphic communication proved to be a complete success.

A DISADVANTAGE OF THE STATE OWNERSHIP OF THE TRUNK TELEPHONE LINES.—At a recent meeting of the Fife County Council the action of an energetic committee, which had recommended that unless the National Telephone Company would agree to pay annual rental of 2s. 5d. per mile per wire, as a return for a permission to run its wires along the highroads, the wires should be cut, was suddenly checkmated by the announcement of the Solicitor that the trunk telephone wires, being now the property of the State, it would be a somewhat hazardous proceeding to cut the wires.

IRON PIPE WIRING.—Now that the objections of the Phœnix Fire Office to any other form of wiring than that which consists in forcing highly-insulated cables into grooves cut in wood casing, and covering the same with a moulded cover, have been overcome, there seems every likelihood of the method of running the wires in iron pipes being largely adopted. I recently had an opportunity of inspecting the new premises of the Commercial Union Assurance Company in Cornhill, where the equivalent of 1,600 8-cp lamps are installed, and where the wires are throughout carried in wrought-iron pipes varying from one half to three quarters of an inch in diameter, broken at intervals by cast iron boxes. Several other insurance offices and banks are also adopting this system of wiring for their premises.

MUNICIPAL ELECTRIC LIGHTING.—The financial results of the municipal central station of Glasgow still continue to be of an unsatisfactory nature. The income for the year ending March 31 last amounted to £21,000 and the ordinary expenditure to £17,000. As the interest on loans and the sinking fund for the redemption of the loans form an annual charge of £5,000, the deficit on the undertaking for the past year amounts to £1,000. I may say in this connection that municipal electric light undertakings have received a further advantage lately, by the success which has attended a large 2½ per cent. loan raised by the London County Council. This success rendered it impossible for the County Council any longer to charge 3 and 3½ per cent. for the money which it lent to the Vestries of London for electric lighting and similar purposes, and it has therefore decided to lend these concerns large sums of money at 2⅞ per cent. When the Vestries first began to contemplate the electric lighting business, they were obliged to borrow at about 3½ per cent.

THE TELEPHONES.—Whether or no the late Postmaster General lost his seat in the recent general election by reason of his attitudes on the telephones I cannot say, but in Glasgow, at any rate, the attitude of the Government on the subject of the telephones led to an appeal to the Glasgow candidates to state whether, if elected, they would do all they could to secure a telephone license for the Glasgow Corporation, and whether they would do their utmost to induce the Post Office to adopt a reasonable tariff for the trunk telephone lines. Amidst all the hurly-burly in connection with the agreement between the Government and the National Telephone Company, the latter steadily continues to make its pile. In the report of the National Telephone Company for the half year ending June 30, it is stated that the income for that period amounted, in round figures, to £394,000, as compared with £360,000. The net profit amounted to £152,000, as compared with £140,000, dividends being paid to the ordinary shareholders at the rate of 5 per cent., which to many of them really means 10 or 12 per cent. on the money they have actually put into the concern.

THE ELECTRIC LIGHTING OF THE THAMES EMBANKMENT.—The scheme for the electric lighting of the Thames Embankment, which has occupied the London County Council for some three years, received a set back on Tuesday. The project for making a central station specially for the purpose, at the cost of some £17,000, did not commend itself to the council as a whole, and the committee in charge of the scheme were requested to ascertain the exact cost of the present system of gas lighting, and to obtain estimates as to the cost of lighting by means of incandescent gas burners, and by arc lamps supplied with current from the mains of some one of the companies. I may say that the County Council Committee estimates for annual expenditure, were as excessive as their estimates for capital outlay. They proposed to erect 83 arc lamps, and estimated that the central-station bill would amount to £2,769, which means some £33 per arc per annum, which, even if we make allowance for the fact that the capital has to be repaid in 42 years, with interest, is a good deal higher than the ruling price for street arcs in this country. I may add that the incandescent burner continues to meet with considerable favor in this country, but notwithstanding persistent pushing, does not make much progress for the purpose of street lighting; several devices in the way of springs have been tried with a view of reducing the number of the breakages of the mantles, but these, hitherto, have not met with great success. The report of the directors of the Incandescent Light Company for the year ending March 31 last, state that the sale of burners for the years ending March 31, 1893, 1894 and 1895 have been approximately 20,000, 105,000, and 300,000 respectively.

# General News.

## New Incorporations.

THE SCENIC RAILWAY COMPANY, capital stock $15,000, has been incorporated at Cleveland, O., by J. B. Hanna, Geo. G. Mulhern, E. W. Radd and others.

THE NORTHERN ELECTRICAL MANUFACTURING COMPANY, Madison, Wis., capital stock $50,000, has been incorporated for the purpose of manufacturing motors, dynamos, generators, etc., by D. C. Jackson, C. M. Couradson, A. O. Fox, W. F. Vilas, Madison, Wis.

THE YANKTOWN GENERAL ELECTRIC COMPANY, Yanktown, S. D., has been formed for the purpose of establishing and operating general electric light plants, by A. T. Nation, Bedford, England; Harry Eller, H. G. B. Swinhoe, Yankton, S. D. Capital stock, $50,000.

THE LA HARPE (ILL.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by Joseph R. Crabill, George Coulson and W. O. Butler to purchase, erect, maintain and operate an electric light and power plant in La Harpe and vicinity. Capital stock $15,000.

THE DUNMORE STREET (PA.) ELECTRIC RAILWAY COMPANY, capital stock $75,000, has been incorporated to construct and operate an electric street railway in Dunmore. The promoters are P. J. Horan and T. E. Boland, of Dunmore, and I. H. Burns, of Scranton, Pa.

THE AUBURN INTER-URBAN ELECTRIC RAILWAY COMPANY, Auburn, N. Y., capital stock $250,000, has been incorporated for the purpose of building and operating an electric railway 25 miles long. Those interested are E. F. Voorhis, J. F. Clark, N. P. Goodhin, W. H. Pixley, Akron, O.

THE HIGHLAND PARK PASSENGER RAILWAY COMPANY, Pittsburg, Pa., capital stock $50,000, has been formed for the purpose of constructing and operating an electric railway, by William B. Rhoads, Joshua Rhoads, Allegheny; O. S. Decker, Robert S. Fraser, Pittsburg, and W. C. O'Reilly

THE CONNERSVILLE (IND.) ELECTRIC LIGHT COMPANY has been formed for the manufacture and production of electricity for illuminating and motive power. The promoters are Edward W. Ansted, William Newkirk, John B. McFarlan, James M. Heron and Thomas Downs. Capital stock $15,000.

THE SYCAMORE LIGHT & POWER COMPANY, Sycamore, has been incorporated by Frank C. Patten, Carrie C. Patten and Thomas L. Halloran, for the purpose of producing and disposing of light, heat and power for public and private use, and for manufacturing all appliances for such purposes. Capital stock, $30,000.

THE LA PORTE CITY ELECTRIC LIGHT & WATER COMPANY, La Porte City, Iowa, has been formed to build, maintain and control systems of electric light and water works, by W. D. Wagoner, E. Duke Naven, A. Van Valkenburg, J. C. Graham, and A. L. Walker, La Porte City, Iowa. Capital stock $15,000.

THE KANSAS & MISSOURI ELECTRIC RAILWAY COMPANY, Pittsburg, Kan., capital stock $25,000, has been formed to operate an electric railway in Crawford County, by Samuel Barrett, Pittsburg, Kan.; Robert Simons, West Chester, Pa.; Robert Rayben, Pittsburg, Kan., and C. J. Simons, Chetopa, Kan.

THE ELECTRIC TRANSPORTATION COMPANY, capital stock $25,000, has been incorporated at Jersey City, N. J., for the purpose of manufacturing and dealing in electric boats to engage in inland navigation. The promoters are Frank Ribbett, Rahway, N. J.; Samuel D. Collett, Brooklyn, N.Y.; Edward B. McCleas, George F. Evans and Charles E. Ainsworth, Jersey City, N. J.

PEORIA & FORT CLARK STREET RAILWAY COMPANY, Peoria, Ill., capital stock $150,000, has been formed to acquire, build, buy, own and operate street railways and plants for producing electricity, and to use, furnish and sell electricity for operating street railways, for light, heat and power purposes. The incorporators are William Barry, Emory D. Frazer and Charles S. Williston.

THE NORTH SUSQUEHANNA TRANSIT COMPANY, Danville, Pa., capital stock $125,000, has been incorporated for the purpose of constructing and operating an electric railway, by E. S. Whitney, Allentown; Robert E. Wright, Allentown; Wilson M. Gearhart, Danville; Edward R. Spousler, J. M. Fitzgerald, Harrisburg; James Scarlett, R. S. Ammerman, and John K. Cerringer, Danville, Pa.

THE DELAWARE COUNTY GAS MANUFACTURING COMPANY, Camden, N. J., capital stock $150,000, has been formed for the purpose of manufacturing and constructing machinery works for heating, cooking or lighting, manufacturing and supplying gas, electricity, etc., for heating, cooking or lighting. The promoters are: C. Hazeltine Basshor, H. C. Turnbull, Jr., Baltimore. Md.; John W. Baker, John J. White, Charles A. Lagen, Philadelphia, Pa.; Lewis Starr, Woodbury, N. J.

## TELEGRAPH AND TELEPHONE.

FRANKFORT, IND.—The telephone war has resulted in a reduction in rates to $1 per month.

ARLINGTON, N. J.—The establishment of a new telephone system at this place is contemplated.

WEST RUMNEY, N. H.—A telephone line is to be extended from this place to Park's Mill, Dorchester.

SOMERFIELD, PA.—The construction of a telephone line from Brandenville to this place is contemplated.

ROCKPORT, TEX.—The Rockport Telephone Company will establish an exchange. C. M. Booth is secretary.

JACKSONVILLE, FLA.—A police telephone system is to be installed here. Mayor Bostwick can furnish particulars.

MIDDLETOWN, CONN.—The telephone line at Camp Coffin is to be built by the Southern New England Telephone Company.

NEW BEDFORD, MASS.—Work has just been commenced on the excavation for the telephone conduit on South Second Street.

JERSEY CITY, N. J.—It is reported that a police signal telegraph system is to be established in Greenville, at an estimated cost of $3,500.

HOUSTON, TEX.—The Texas Telegraph & Telephone Company will establish an exchange in this city. Address B. Krain for particulars.

CLARKSVILLE, TENN.—The construction of a telephone line to neighboring towns is contemplated. J. H. Lory can furnish detailed information.

GLENS FALLS, N. Y.—The Hudson River Telephone Company has decided to build a new line from this place to Whitehall, a distance of over 20 miles.

BANGOR, ME.—The Dirago Telephone Company has applied for permission to erect poles and lay subways in certain streets of the city for the purpose of establishing a telephone system.

ALBANY, N. Y.—An ordinance has been passed granting the Home Standard Telephone Company permission to construct, equip and maintain an electric telephone and telegraph wire in this city.

NEW ORLEANS, LA.—The construction of an underground conduit system for building telephones, electric light and other lines is contemplated. Engineer Periliatt, one of the State engineers, is in charge of the matter.

LIMA, O.—As a result of the telephone war here, the Central Union Company has announced a reduction to take effect Aug. 1. The new rates are $24 for business 'phones and $15 for residence 'phones, against their present rate of $36 and $30.

HAZELHURST, MISS.—The Mississippi Telephone Company is preparing to install a telephone exchange here which will connect with all out-going toll lines. The King-Price Telephone Company will extend its system to Jackson, Miss., this month.

JACKSONVILLE, FLA.—An exchange is to be established by the Jacksonsonville Telephone Company. Bids are wanted for telephone equipment for 400 subscribers. W. M. Shine, of Tallahassee, and A. H. King, of this place, are among the directors of the company.

KENT, O.—The telephone line has been completed between this place and Lake Brady, and will be extended to Ravenna. Exchanges are being constructed at Ravenna and Kent, each of a capacity of 100 telephones; the work is under the supervision of P. D. Myers, representing the American Telephone Company.

## ELECTRIC LIGHT AND POWER.

OLYPHANT, PA.—A new electric light plant is to be erected here.

ORANGE, N. J.—Eight thousand dollars has been appropriated for electric street lighting.

CASSOPOLIS, MICH.—The installation of an electric lighting plant at this place is contemplated.

UTICA, N. Y.—The extension of the electric light system is contemplated. Address the city clerk.

PATTERSON, PA.—An electric lighting system is to be established here for the purpose of lighting the streets.

GRANVILLE, N. Y.—A new electric plant is to be established here. The village clerk can furnish particulars.

OXFORD, ME.—The Rumford Falls Light & Power Company is making a number of improvements in its plant.

MONTGOMERY, ALA.—The Montgomery Cotton Mills Company is in the market for a 200-light incandescent plant.

LANSINGBURG, N. Y.—A site has been purchased by the Electric Light Company, on which a plant will be erected.

MILAN, ILL.—The installation of an electric light system is contemplated. Address the clerk of the council for particulars.

HOT SPRINGS, ARK.—A company has been organized for the purpose of developing the local water power for the generation of electricity.

BRUNSWICK, ME.—The electric light plant of this place is to be enlarged and improved at once. Modern electrical machinery will be installed.

HARVARD, ILL.—An electric lighting plant is to be established here in the near future. The clerk of the council can supply definite information.

CANTON, MISS.—A new electric light and water works plant is to be erected by the city. Address H. W. Latimer, city clerk, for particulars.

RAHWAY, N. J.—It is reported that a new electric lighting system is to be established here. The clerk of the council can give definite information

ATHENS, GA.—The new cotton mill which is to be erected in this city is to be lighted by electricity. C. G. Talmadge and W. Colman are interested.

BRIDGEPORT, CONN.—The Centre Bridge draw is to be equipped with electric power. Street Commissioner Lasher can give detailed information.

INDIANAPOLIS, IND.—It is reported that an electric lighting system is to be installed in Tomlinson Hall. Address the Board of Works for detailed information.

ROCKPORT, TEX.—An electric light plant is to be erected here by the Rockport Light & Power Company. Bids will be received by the company for the apparatus, etc.

AVERILL PARK, N. Y.—Plans have been prepared for the lighting of the village with electricity. The directors of the Sand Lake Railway can furnish further information.

PHILADELPHIA, PA.—The new ten-story fireproof building for the New York Mutual Life Insurance Company, at 1007-1011 Chestnut Street, will be wired and fixtured throughout for electric lighting.

BROOK HAVEN, MISS.—A complete electric light plant is to be erected by the Brook Haven Manufacturing & Improvement Company. All necessary equipment and machinery for same will be required.

PHILADELPHIA, PA.—An ordinance has been passed granting permission to the Pennsylvania Heat, Light & Power Company right of way through certain streets of the city for the purpose of supplying light, heat and power.

MILWAUKEE, WIS.—Sealed proposals will be received until Aug. 19 for the electric lighting of the streets of the city, for periods of one, two, five and ten years, from Dec. 15, 1895. Address Wm. F. Fredantz, comptroller, for particulars.

KNOXVILLE, TENN.—It is reported that the East Tennessee Telephone Company is contemplating the erection of an electric lighting plant to furnish arc and incandescent lights for the city, also the establishment of a telephone exchange.

PROVIDENCE, R. I.—The new clubhouse which is to be erected for the Harbor View Club on Thames Street is to be wired and fixtured throughout for electric lighting. H. F. Minsher, secretary of the club, can be addressed for details.

## THE ELECTRIC RAILWAY.

BROCKTON, MASS.—An electric railway is to be built between this place and North Easton.

NEBRASKA CITY, NEB.—It is reported that the horse-car line is to be converted into an electric system.

AUGUSTA, GA.—It is reported that the Augusta Railway Company will extend its road to Lake Olmstead.

QUEBEC, CAN.—The Electric Street Railway broke ground this week preparatory to laying their rails in this city.

OLD ORCHARD, ME.—The construction of an electric road between this place and Kennebunkport is contemplated.

FISHKILL, N. Y.—Surveys are being made for the building of an electric road to connect Wappinger's Falls and Fishkill.

PALMYRA, N. Y.—The construction of an electric railway from the Central Hudson Railway to this village is contemplated.

BRUNSWICK, MD.—The construction of an electric railway from this place to Middletown via Burkettsville is contemplated.

GORHAM, ME.—The construction of an electric road is projected from Saccarapps to this place. Charles Libby is interested.

CAMDEN, N. J.—The Camden Horse Railway Company has applied for permission to construct a trolley line on the river road.

MAYVILLE, N. Y.—An electric railway is projected from Chautauqua through this place to Barcelona Harbor on Lake Erie.

SCHOHARIE, N. Y.—An electric railway is to be built to this place in the near future. Ezra Twitchwell can furnish particulars.

TOTTENVILLE, S. I., N. Y.—The Amboy Division of the Staten Island Rapid Transit Railway is to be extended in the near future.

McKEESPORT, PA.—An application for a franchise has been made for the construction of a road from this city to Rostraver, a distance of nine miles.

HOMESTEAD, PA.—Work will be commenced at once on the construction of the Homestead & Highland Electric Railway from this place to Du Quesne.

PITTSBURG, PA.—Work has been commenced on the construction of the line from Twenty-third to Main Streets by the Fort Pitt Street Railway Company.

HILLSBORO, TEX.—The Hillsboro Street Railway Company is contemplating the construction of a trolley line at once. J. H. Graham, of Boston, is president.

CAMDEN, N. J.—The Camden, Gloucester & Woodbury Railway Company has been granted permission to extend its lines from Kaigns Avenue to Federal Street.

ELYRIA, O.—A franchise has been granted by the County Commissioners for the purpose of building an electric road from this city to Lorain, via Lake Avenue.

WASHINGTON, PA.—A company is being organized for the purpose of building a line from this place to Woodside, Linden and Forest Glens. Benjamin F. Leighton is interested.

SAUGERTIES, N. Y.—The construction of a trolley line here is contemplated. It will be a single track road, commencing at the Long Dock, and will run to the West Shore Railway depot.

BINGHAMTON, N. Y.—Work will be commenced this Fall on the construction of the Binghamton, Lestershire & Union Electric Railway, to be constructed between the points named.

BALTIMORE, MD.—A committee has been appointed to secure right of way for an electric line to Witheredsville and Franklintown in the suburbs. P. H. Judik, president of the People's Bank, is interested.

PATCHOGUE, L. I., N. Y.—A company is to be incorporated for the purpose of building the Patchogue & Port Jefferson trolley line. O. T. Fanning, of Riverhead, and J. T. Sweezie, of this place are interested.

TOWER CITY, PA.—A company has been organized for the construction and operation of a trolley road from this city to Lykens, for which right of way has been secured. Philip Portner, of Girardville, is interested.

NEWARK, N. J.—A franchise has been applied for by the Suburban Traction Company to build an electric line through Union and Nassau Streets and Valley Road. The secretary of the company can be addressed for detailed information.

TACOMA, WASH.—The electrical equipment of the Tacoma Traction Company's line from Tacoma to Fern Hill and Puyallup has been completed, and the new motor cars have superseded the steam dummies operating on that portion of the line.

## Personal Note.

MR. WM. S. CHESLEY, whose portrait we present herewith, was born at Hannibal, Mo., in 1860, and is therefore 35 years old. After receiving a common school education he commenced his electrical career in 1876, working six months as a messenger for the Western Union Telegraph Company, for an opportunity to learn. He left the service temporarily to accept a clerkship, but subsequently returned to telegraph work, obtaining his first position as operator in 1878. A year later he was appointed manager of the American Union Telegraph office at Hannibal, and on the consolidation of that company with the Western Union in 1880 he was sent to Kansas City. He soon became an expert operator and after working in several large cities was in 1882 appointed chief operator at Little Rock, Ark. In 1884 he was appointed manager of the office at Galveston, Texas, the largest relay office in that section and the terminus of the Mexican & Southern Cables. He came to New York in 1888, to engage in electric lighting, but inexperience and poor health offered serious drawbacks. He worked about a year in the construction department of the United States and Westinghouse companies, and later acted as salesman for the Continental Dynamo Company, in which he was quite successful. In 1890 he started in business for himself as an electrical engineer and broker, making a specialty of second-hand machines, and in 1892 opened a repair shop in Jersey City. He subsequently purchased the property at 601 to 605 Newark Street, Hoboken, where he is now located, and has extended his facilities from time to time as increasing business demanded, until his shops now present a very active and thriving appearance.

## Miscellaneous Notes.

THE AMERICAN ELECTROTHERAPEUTIC ASSOCIATION will hold its fifth annual meeting at the College of Physicians and Surgeons of Ontario, in Toronto, Can., on Tuesday, Wednesday and Thursday, Sept. 3, 4 and 5 1895. Dr. Emil Heuel, 352 Willis Avenue, New York, is secretary.

INVITATIONS ARE OUT for the 17th annual clambake of the American Electrical Works, of Providence, R. I., to be held on Saturday, Aug. 17, at Haute Rieve. This event will celebrate the 25th anniversary of the establishment of the company's business, and a thoroughly enjoyable occasion is to be expected.

# Trade and Industrial Notes.

THE BRYAN-MARSH COMPANY, of 136 Liberty Street, New York, reports that the West End Street Railway, of Boston, Mass., after a most exhaustive test, have adopted the Bryan-Marsh lamps and closed a contract for its annual supply.

OVER HALF A MILE OF ROPE, more exactly, 3,000 feet, has been ordered by the Los Angeles (Cal.) Electric Company from the C. W. Hunt Company, 45 Broadway, New York, for a rope-drive in the electric light station. The celebrated "Stevedore" brand will be used.

A LARGE ORDER has been placed by the Southern Electric Light & Power Company, of Philadelphia, with Chas. A. Schieren & Co., 45 Ferry Street, New York. The order covers three 3-ply belts each 64 inches wide and 162 feet long, and one belt 64 inches by 94 feet, an aggregate of about 3,100 square feet.

EXCLUSIVE CONTROL for the United States of Gale's Commutator compound has been obtained by the Electric Appliance Company, of Chicago. Quite a demand is already being manifested for this well-known article, and the "American Flag" dry battery, recently acquired, is also proving something of a favorite with the trade. Mr. W. W. Low, president of the company, is away on a well-earned vacation, making a tour of the Northwest.

"IN A NUTSHELL" is the title of a little pamphlet issued by Hine & Robertson Company, of 57 Cortlandt Street, New York, explaining fully all the facts connected with the use and operation of the Planimeter, used in conjunction with indicator cards. In a conversation with them the surprising fact developed that but few electric light or street railway plants have an indicator. When managers come to realize that only by the use of the indicator can they keep a check on their engines we feel confident that a greater number of them will be used.

H. E. COLLINS & CO., sole agents for the Cahall vertical water-tube boilers, manufactured by the Aultman & Taylor Machinery Company, of Mansfield, O., reports the following among other recent sales of Cahall boilers: Cornwall Iron Company, Cornwall, Pa., 500 hp; Wellsville Plate & Sheet Iron Company, Wellsville, O., 500 hp; Apollo Iron & Steel Company, Pittsburg (third order), 7,000 hp; Union Iron & Steel Company, Youngstown, O., 300 hp; Andrews & Hitchcock Iron Company, Youngstown, O., 250 hp; Union Rolling Mill Company, Cleveland, O., 150 hp; Logan Iron & Steel Company, Lewistown, Pa., 150 hp; Siemens & Halske Electric Company, Chicago, 250 hp. Messrs. Collins & Co. report that they have been under great pressure to fill orders received, but are now relieved by the addition to their plant now partially in operation, which, when finished, will be capable of turning out 1,000 hp per day.

THE BASS FOUNDRY & MACHINERY WORKS, of Fort Wayne, Ind., reports through its Eastern manager, Mr. F. Ruel Baldwin, that the works are running 24 hours a day. Besides a number of standard engines the company has recently installed two 19-36x48-inch cross-compound engines at the plant of the New Jersey Electric Railway Company at Hoboken, N. J., rated at 500 hp each, and the Ocean Grove Association, Ocean Grove, N. J., has just started a 30x48 improved Bass engine, which, when the plant is completed, will be compounded with a 20x42-inch Corliss engine now in the old station; the boilers, three 72x18 return tubular, with butt joints, double covering strips and triple riveted for carrying high pressure, were also furnished by the Bass Company, together with piping, etc., complete. The Bristol & Plainville Tramway Company has added to the present lighting plant, installing a 16x36 and a 16-30x42 cross-compound engine; the former is in place ready to run, and the compound is nearly ready for shipment. A 150-hp Bass engine and boiler, designed for high pressure, are being installed by the New England Engineering Company, of Waterbury, Conn, in an electric lighting plant at Branford, Conn.

SIX THOUSAND HORSE-POWER in Ide and Ideal engines are reported by W. R. Fleming & Co., representing the Harrisburg Foundry & Machine Works, of Harrisburg, Pa., as having been sold during the past three months through their offices in New York, Boston and Philadelphia, exclusive of sales made outside their territory. The list is as follows: One 160-hp, direct-connected to Siemens & Halske, dynamo for Hotel San Remo, New York; one 150-hp, direct-connected to General Electric dynamo for New York Life Insurance Company, New York; three 150-hp, direct-connected to Crocker-Wheeler dynamos for Hotel Walton, Philadelphia; two 50-hp, direct-connected to General Electric dynamos for Fahys' Building, New York; one 150-hp tandem compound engine to the S. O. & C. Company, Ansonia, Conn.; one 80-hp and one 120-hp, direct-connected to General Electric dynamos for Germania Life Insurance Company, New York; two 30-hp, direct-connected to General Electric dynamos for Hotel Stenton, Philadelphia, Pa.; one 40-hp and one 60-hp for W. H. Hayden, Bath, Me.; one 25-hp to Brigham Electric Company, Boston; two 400-hp direct-connected to General Electric railway generators for export to Rio Janeiro; one 30-hp for Columbia Spinning Company, New Bedford, Mass.; one 20-hp for new city hall, Brockton, Mass; one 300-hp tandem-compound Ide engine for export to South Africa; one 75-hp Ide for American Surety Building, New York; two 750-hp tandem-compound

railway engines (Ide) direct-connected to General Electric dynamos for Philadelphia, Castle Rock & Westchester Railway Company, Philadelphia, Pa.; two 80-hp direct-connected General Electric dynamos to Bar Association Building, New York; two 50-hp direct-connected to dynamos for the Lorsch Building, New York; three 125-hp direct-connected to dynamos and three 125-hp Harrisburg boilers, with complete steam construction, for U. S. Custom House, New York; two 200-hp tandem compound engines and one 40-hp simple for magnificent new Hotel Royal (Poinciana, Fla.); one 100-hp engine for Larchmont Electric Company, Mamaroneck, New York; one 60-hp for Mail and Express Building, New York; one 25-hp engine and one 25-hp boiler General Electric Company, Foreign Department, Schenectady; one 15-hp, Manhattan Railway Company, New York; three 125-hp direct-connected to Siemens & Halske dynamos for apartment house, Seventy-fifth Street and Columbus Avenue, New York; three 50-hp direct-connected to Eickmeyer dynamos for elevator service in Fahys' Building, New York.

# Business Notices.

ELECTRIC LEAGUE.—Meets every Thursday evening, 100 West 24th Street, New York. Electrical engineers and electricians cordially invited.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren Street, Syracuse, N. Y.

ELECTRICAL FIRMS thinking of handling bicycles are very anxious to obtain the agency of some wheel that is not in the repair shop oftener than on the road. When we recommend the Keating, which is advertised on page xviii. we believe we are recommending the staunchest light bicycle in the country.
THE KEATING WHEEL CO.

# Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED AUGUST 6, 1895.
(In charge of Wm. A. Rosenbaum, 177 Times Building, New York.)

543,653. ELECTRIC BRAKE-SHOE; Schenectady, N. Y. App. filed March 30, 1895. An electric shoe consisting of a magnet arranged about a car axle, the shoe being adapted to slide on its point of suspension, and a spring connection by means of which the said shoe is moved back to and retained in its normal position.

543,836. ALTERNATING-CURRENT MOTOR; E. Arnold, Zurich, Switzerland. App. filed Oct. 9, 1894. A motor consisting of field coils having terminal connections for the external circuit, armature coils, a commutator therefor, commutator brushes, and a device controlled by the speed of the motor for automatically directly short-circuiting the armature coils.

543,843. TELEPHONE; J. S. Biggar, San Francisco, Cal. App. filed Nov. 16, 1894. A telephone consisting of a circuit in which electrical undulations are set up by sound waves, an electromagnet in said circuit, a main circuit, a portion of which consisting of a piece of bismuth is located in the field of force of the said magnet.

543,855. SHORT-CIRCUITING DEVICE FOR DENTAL MOTORS; F. N. Dennison, Toronto, Can. App. filed Oct. 9, 1894. A motor having a shunt field and a circuit, a foot switch interposed in said circuit and comprising a hollow base plate having a rheostat beneath the same, the series of contacts connecting therewith, arc-shaped contact plates connected with the poles of the armature, and the foot lever pivoted to swing both vertically and horizontally, and also having a contact arm to engage the series contacts as the pedal is swung laterally, and a second contact arm for connecting the two arc-shaped plates as the pedal is swung vertically.

543,865. ELECTRIC METER; J. Harris, Lynn, Mass. App. filed Oct. 4, 1894. The combination of a pressure coil and a motor, a torsion spring connected to the coil and to the motor, whereby the torsion of the spring automatically balances the torque of the coil.

543,867. CONSTRUCTION AND OPERATION OF ELECTRIC RAILWAYS AND TRAMWAYS; J. W. Heysinger, Philadelphia, Pa. App. filed April 11, 1892. A railway having a continuous heat-supplying pipe extending along each rail, separate from but parallel to the same, the said pipe being surrounded with a partially diathermal and water-proof non-metallic covering, and having a heated solution forced through it, and means for establishing a continuous flow of the heated solution.

543,879. AUTOMATICALLY OPERATED FIRE ALARM; F. K. Ludlow, Madisonville, O. App. filed Dec. 18, 1894. The combination of suitable circuit wheels having driving connections, the driving connections being controlled by an escapement, a drop frame normally in engagement with the said escapement but insulated therefrom, and a series of drop levers which are adapted to control the frame and having connections whereby they are released by the heat of a fire.

543,885. ELECTRIC BATTERY; R. McL. and A. Mc Donald, Dalmuir, Scotland. App. filed Nov. 13, 1894. A battery consisting of an outer jar containing a solution of sulphate of copper, an inner porous cell containing chloride of sodium, the electrode being in porous cell, the cinders in the outer cell and a spiral conductor arranged to hold the cinders in place.

543,892. METHOD OF AND MEANS FOR EXTINGUISHING ELECTRIC ARCS; W. B. Potter, Schenectady, N. Y. App. filed Nov. 30, 1894. A method of extinguishing arcs which consists in inclosing the arc within a chute or refractory insulating material closed at the sides and open at both ends arranged to co-operate with other arc-extinguishing means.

543,895. CONSTRUCTION OF ARMATURES FOR DYNAMO-ELECTRIC MACHINES; W. B. Sayers, Bearsden, Scotland. App. filed Aug. 16, 1894. A method which consists in fixing portions of the armature winding in the armature core, engaging other portions of the winding by a holding device, rotating the armature core with the portions of winding secured thereto, so as to cause portions of the windings to be symmetrically bent about the axis of the armature, and means for securing the same in place.

543,900. ELECTRIC ARC LAMP; C. E. Scribner, Chicago. Ill. App. filed March 12, 1891. The combination of two arc lamps, each having an electromagnet adapted to cut out or cut in the said in circuit, the electromagnets being so wound that the current will actuate one armature to cut in one lamp, a current in the opposite direction will actuate the second armature to cut the second lamp into circuit.

543,901. App. filed Nov. 12, 1894; 543,902. App. filed Dec. 8, 1894. TELEPHONE APPARATUS; C. E. Scribner, Chicago. Ill. A telephone system consisting of a plug constituting the terminal of the circuit, a plug seat-switch for the plug controlling the connection of an operator's telephone with the circuit, a relay also controlling the connection of the telephone with the circuit, the relay being itself controlled by circuit connections closed by the insertion of the plug into a springjack.

543,907. CONTROLLING PHASE RELATIONS; C. P. Steinmetz, Lynn, Mass. App. filed Sept. 9, 1893. The combination of a phase controller coupled directly in circuit so as to accelerate or retard the current relatively to the electromotive force as required, and a regulator responsive to changes in current strength for varying the accelerating or retarding influence.

543,919. METHOD OF CONNECTING ENDS OF ELECTRICAL CONDUCTORS; J. T. Beswick, Brooklyn. N. Y. App. filed Feb. 9, 1895. A method of connecting which consists in providing a rod or wire with a slot, inserting within it one of the wires forming a portion of the electric circuit and which is provided with one or more notches for the insertion of the electric conductors.

543,929. ELECTRIC TEMPERATURE CONTROLLING DEVICE; S. A. Ekehorn, Milwaukee, Wis. App. filed May 1, 1894. A controller consisting of a thermostat fastened at one end to vibrate at its opposite end, and formed of two parallel-extending differentially-expanding sections, fastened together, one section being convoluted.

543,931. PRIMARY BATTERY; G. H. Gardner, Boston, Mass. App. filed July 5, 1894. The combination of a binding post having a metallic connection passing through the bottom of the cell and terminating in a flat curved spring so arranged and located that in placing the zinc element into the cell an automatic connection is made.

543,933. ELECTRIC SIGNAL FOR RAILWAY TRAINS; J. C. Henry, Westfield, N. J. App. filed April 20, 1895. A system of signaling which consists of a magnetic electric alarm located on the locomotive, a circuit throughout the train and switches arranged at the gates of the cars whereby an alarm is actuated by the opening of any one of the said gates, and the opposite alarm is given by the closing of the gates.

43,950. SYSTEM OF ELECTRIC DISTRIBUTION; E. Thomson, Swampscott, Mass. App. filed June 28, 1894. A method of regulating the potential of an alternating current which consists in connecting an impressing circuit to a coil at various distances from its ends, and connecting an impressed circuit to the coil at various distances from the impressing circuit connections.

543,960. ELECTRICAL CONDUCTOR; G. Gray, Boston, Mass. App. filed Dec. 14, 1894. A conductor consisting of a wire grooved spirally in opposite directions so that the spirals will intersect or cut across one another at each turn or twist of the wire.

543,963. RHEOSTAT-CONTROLLER; C. Landers, Tacoma, Wash. App. filed March 27, 1894. The combination of an upright board having a series of plates at its upper end and a series of buttons at its lower end, both being connected respectively by wires, the buttons being also in circuit with a resistance coil, a series of reversing switches or segments beneath the plates electrically connected with a set of buttons, and other electrical connections between the buttons and the motors, connections with the trolley and rails, and an operating lever pivoted in the board carrying a series of contact points.

543,965. ELECTRICAL HIGH OR LOW WATER ALARM; B. McCabe, Boston, Mass. App. filed Dec. 15, 1894. The combination of a float having a rock shaft secured to it, a vertical rod extending outside of the boiler, a gear on its lower end and an arm on its outer end adapted to engage with the rock shaft and also forming one electrode, and a plate on a support making the other electrode and an electrical circuit and a sounding device.

543,966. CIRCUIT CLOSER. W. Nutt, Crawfordsville, Ind. App. filed Nov. 6, 1894. The combination of a crank shaft carrying an arm and contacting with spring plates, contact pins which contact with the plates and springs for maintaining the arm normally out of contact with the plates and returning it to its original position.

543,978. ELECTRIC CONDENSER. C. S. Bradley, Avon, N. Y. App. filed May 11 1895. A condenser consisting of a series of conductive plates or surfaces connected in groups with polyphase terminals, the members of said groups being interleaved with one another.

543,984. SYSTEM OF MULTIPLEX TELEGRAPHY; T. B. Dixon, Henderson, Ky. App. filed Oct. 19, 1894. The combination of a line conductor and a transmitting instrument arranged to vary the line current, a receiving instrument corresponding to the transmitter and operated by a dead-beat relay, and a second relay operated by variations in the line current, controlling the dead-beat and arranged to cause the armature of the said relay to be deflected in one direction or the other, according to the position of the armature of the second relay.

543,985. INCANDESCENT CONDUCTOR FOR ELECTRIC LAMPS; T. A. Edison, Menlo Park, N. J. App. filed Aug. 7, 1882. A conductor composed of carbonized unstructural cellulose or other carbo-hydrate or a compound thereof.

543,986. PROCESS OF TREATING PRODUCTS DERIVED FROM VEGETABLE FIBRE; T. A. Edison, Menlo Park, N. J. App. filed Oct. 20, 1882. The process of forming flexible sheets from vegetable fibres which consists in treating such fibre with hydrofluoric acid and pressing the resulting material into sheets.

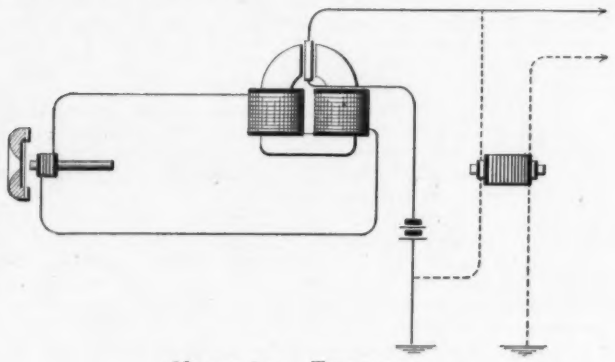
543,987. FILAMENT IN ELECTRIC LAMPS; T. A. Edison, Menlo Park, N. J. App. filed Oct. 20, 1882. The same process as the above.

544,015. TEMPERATURE REGULATOR; G. H. Underhill and E. Glantzberg, Boston, Mass. App. filed Nov. 17, 1893. The combination of a controlling device, means for imparting motion to the same, magnetically controlled detents for normally holding the actuating means out of action, a generator, a circuit closer and a thermostat in circuit and adapted to close the circuit through the electromagnet of one or the other of the detents whenever the temperature rises or falls from a predetermined limit.

544,024. VISUAL INDICATING DEVICE; C. C. Bramwell, Hyde Park, Mass. App. filed Oct. 18, 1894. The combination of a rotatable conducting member carrying an insulated segment, one or more insulated contacts acting upon the member and segment, an electromagnet and its armature co-operating with the said member and segment.

544,034. ELECTRIC LIGHTING SYSTEM; E. F. Gavin, New York, N. Y. App. filed Sept. 28, 1894. A lamp support consisting of a form provided with holes for bulb stems of insulating material attached to the lamp support sockets having detachable connection with the said rings, and contact pieces on the rings and sockets.

544,037. CONVERTER SYSTEM FOR ELECTRIC RAILWAYS; T. Harper, New Brunswick, N. J. App. filed June 29, 1894. The combination of a series of transformers located along a railway, the coils of which are in circuit with a generator, and having closed magnetic circuits, a movable flexible secondary coil in the conduit, the axis of the coil being parallel with the axis of the conduit, a vehicle which carries the secondary coil and a motor in the vehicle in circuit with the said coil.



No. 543,843.—Telephone.

544,047. RHEOSTAT; W. O. Meissner, Chicago, Ill. App. filed Nov. 20, 1893. The combination of a rotatable cylinder with a spiral ridge, insulation covering the ridge and cylinder, a resistance wire around both, its successive coils separated from each other, a connection with one end of the resistance wire, a contact bar, a connection therefrom, the cylinder being rotated if the contact bar engages with the resistance wire on the top of the ridge.

544,056. CONDUIT SYSTEM FOR ELECTRIC RAILWAYS; J. and W. R. Thomas, Catasauqua, Penn. App. filed Dec. 6, 1894. The combination of a conduit, positive and negative conductors therein, trolley wheels adapted to engage said conductors, and conductors for electrically connecting the motor or motors with a source of supply and also furnish a return conductor.

544,066. ELECTRIC ARC LAMP; J. A. Mosher, Chicago, Ill. App. filed May 11, 1895. A lamp consisting of a frame carrying a transforming agent and having its secondary circuit wholly within the lamp, a pair of movable electrodes forming a part of the secondary circuit and means for maintaining the electrodes in continuous contact.

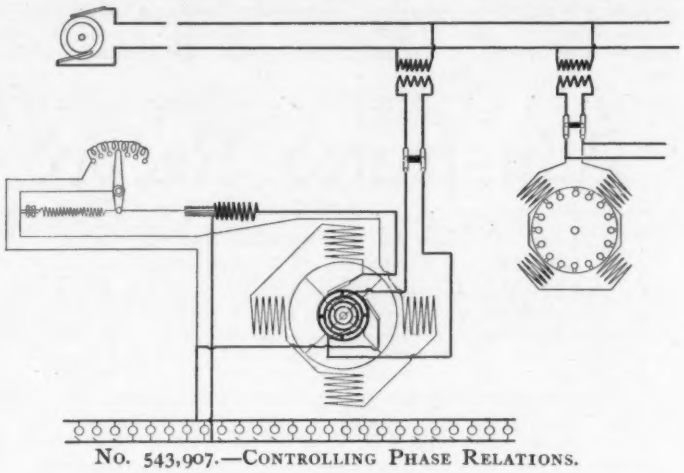
544,084. FIRE ALARM SIGNALING APPARATUS; G. W. Brown, West Newbury, Mass. App. filed Sept. 1, 1892. The combination of an electromagnet, a polarized armature mounted to rotate or oscillate in a plane parallel with the acting surfaces of the poles of the electromagnet, a pointer or visual signal affixed to the armature, an audible signal or gong having a striking mechanism and a let-off mechanism controlled by the said armature.

544,085. APPARATUS FOR STOPPING ENGINES; G. W. Brown, West Newbury, Mass. App. filed June 8, 1895. The combination of a steam conduit having an outlet and a cylinder, a piston movable in the cylinder, an outlet valve and a shut-off valve, both connected with the piston, a vent controlling the operation of the piston and valve, and speed controlled means for opening the vent.

544,094. AUTOMATIC CUT-OUT FOR ELECTRICAL CONVERTERS; W. J. Greene, Cedar Rapids, Iowa. App. filed March 9, 1895. The combination of a source of electrical energy and primary and secondary mains communicating therewith, a converter in circuit with the two mains through switches, an electromagnet in circuit with the secondary main, and an armature in circuit with the secondary main and provided with terminals, switches, levers, etc.

544,107. MAGNETO-ELECTRIC BELL; L. Moore, Brooklyn, N. Y. App. filed April 11, 1895. The combination of an electromagnet pivoted at or near the central point of its major axis, four permanently magnetic pole-pieces arranged in pairs of similar polarity, sheets of brass fixed in position to make contact thereto, and a hammer operated by the electromagnet to strike a gong.

544,118. SAFETY ELECTRIC MOTOR; W. R. Polk, Jr., Atlanta, Ga. App. filed Feb. 20, 1894. An electric motor having a device or mechanism to prevent burning out by excessive current by automatically cutting off the current upon its exceeding a predetermined point, also to use part of the coils of the field magnet for the variable resistance in the armature circuit.



No. 543,907.—Controlling Phase Relations.

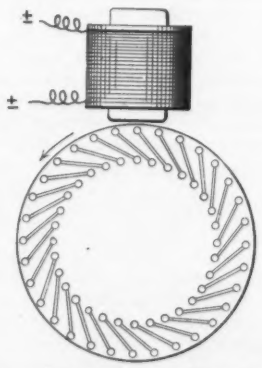
544,123. ELECTRIC SIGNALING SYSTEM; C. A. Rolpe, Chicago, Ill. App. filed Jan. 8, 1895. A system consisting of a signaling transmitting mechanism from which signals are sent over a main line to a main or central station and an auxiliary or house circuit including means for liberating the signal transmitting mechanism so that the latter which is normally wound up may when released run down, and while so doing transmit signals over the main line.

544,157. TROLLEY WHEEL; J. Conway, Baltimore, Md. App. filed Jan. 4, 1895. A trolley wheel having a spiral ridge thereon, two side flanges, one on each side of the central spiral adapted to direct the line wire from the flange to the central groove.

544,198. ELECTRIC RAILWAY; F. Taylor, Charlotte, N. C. App. filed Nov. 30, 1894. The combination of a conduit having a live wire at one side, a vehicle carrying a movable frame with contact members adapted to make contact with the said live wire.

544,209. ELECTRIC RAILWAY; J. Claret & Co., Wuilleumier, Lyons, France. App. filed July 25, 1893. An electric railway having a series of spaced contact surfaces, a main conductor adapted to supply current to the surfaces in succession, an automatic distributer having terminals connected to the surfaces and means for bringing the contact surfaces successively into electrical connection with the main conductor one at a time and locking it until the succeeding surface is reached by the car.

544,236. CONTROLLING SWITCH FOR ELECTRIC MOTORS; W. J. Pohlman, Woodbrook, Md. App. filed June 4, 1895. A switch comprising an electromagnet, an armature for the same, contacts, brushes arranged around the contacts, a circuit making and breaking sector having contact points normally out of engagement with other contacts, a separate contact having permanent contact with the sector and one pole of the battery, and a circuit for the electromagnet including one of the contact points on the sector, the corresponding adjacent contact, and the separate permanently connected contact.




No. 544,261.—Alternating-Current Motor.

544,261. ALTERNATING-CURRENT MOTOR; R. Lundell, Brooklyn, N. Y. App. filed Oct. 22, 1894. An alternating motor having two sets of inductive coils, one of which acts as a primary and the other as a rotary secondary thereto, the coils of the secondary being closed upon themselves and disposed at angles to the radial lines of the axis about which they rotate.

544,266. MEDICAL INDUCTION COIL; J. Tatham, Philadelphia, Pa. App. filed Oct. 15, 1891. The combination of a battery and an induction coil, with a switch having four points and two arms adjustable so as to bear upon any two adjoining points of the switch, and connections whereby the current controlled by the switch may be either a primary or a secondary current or a combined primary and secondary current.